Taco System Logic (TSL)

302-370

Installation, Operation, and Maintenance Manual

SUPERSEDES: June 27, 2014

EFFECTIVE: December 21, 2015

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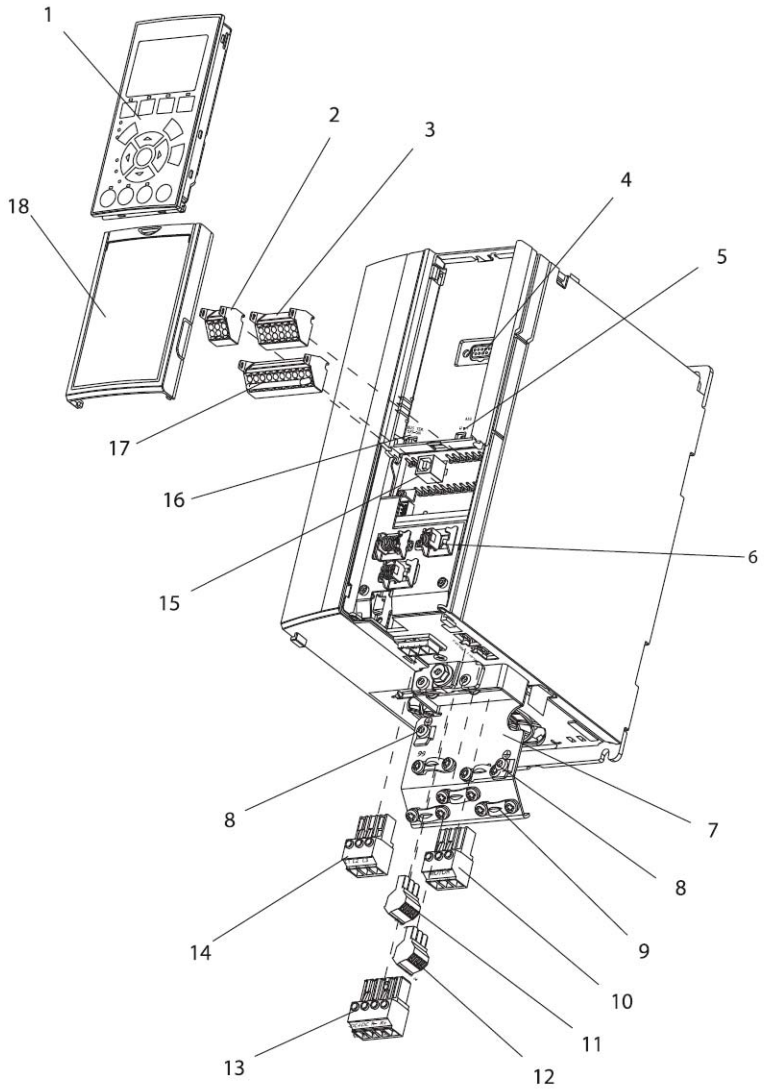
1 ELECTRICAL CONNECTIONS

1.1 Exploded Views

Figure 1-1: Exploded View A Size



1	LCP	10	Motor output terminals 96 (U), 97 (V), 98 (W)
2	RS-485 serial bus connector (+68, -69)	11	Relay 1 (01, 02, 03)
3	Analog I/O connector	12	Relay 2 (04, 05, 06)
4	LCP input plug	13	Brake (-81, +82) and load sharing (-88, +89) terminals
5	Analog switches (A53), (A54)	14	Line power input terminals 91 (L1), 92 (L2), 93 (L3)
6	Cable strain relief / PE ground	15	USB connector
7	Decoupling plate	16	Serial bus terminal switch
8	Grounding clamp (PE)	17	Digital I/O and 24 V power supply
9	Shielded cable grounding clamp and strain relief	18	Control cable cover plate

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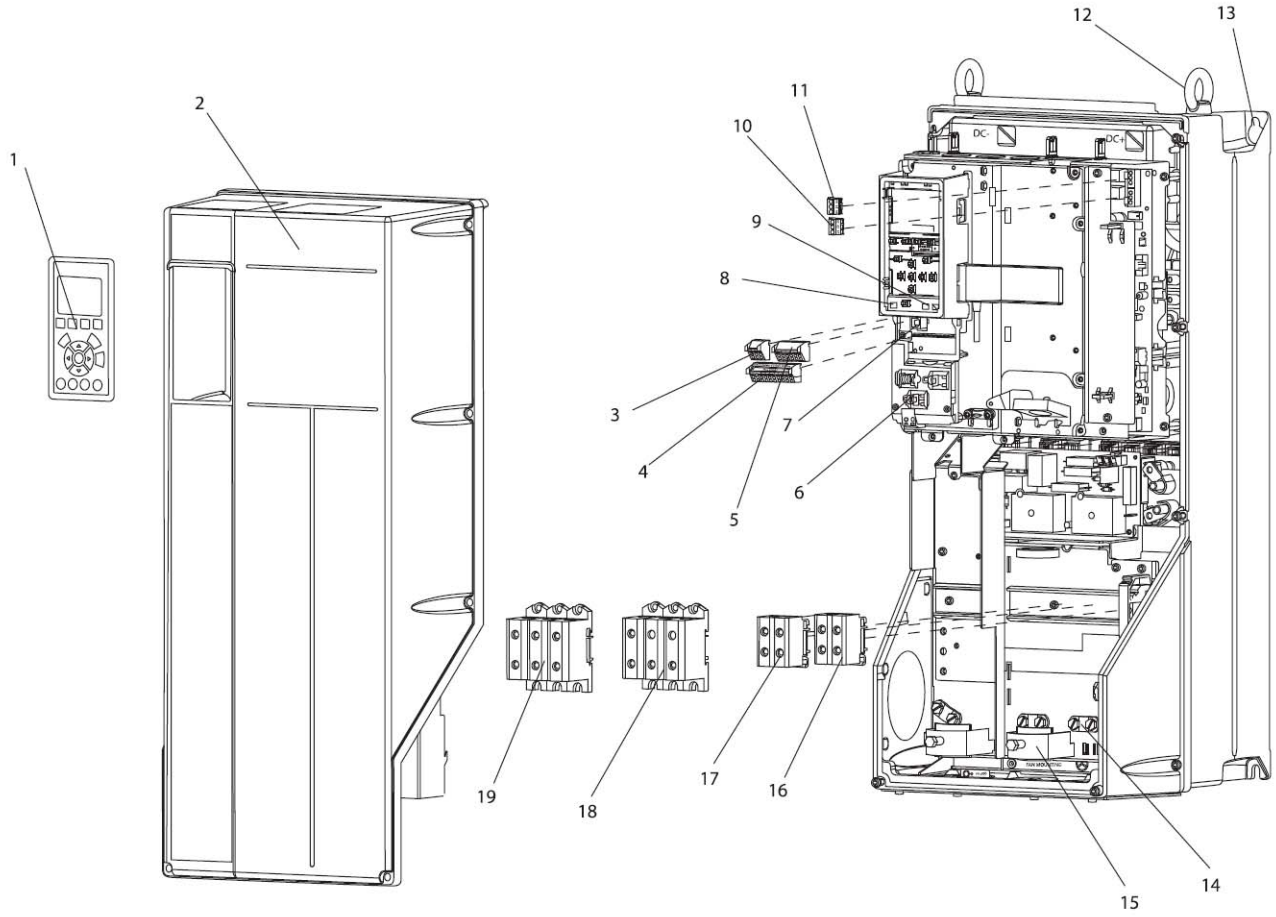
Figure 1-2: Exploded View B and C Sizes



1	LCP	11	Relay 2 (04, 05, 06)
2	Cover	12	Lifting ring
3	RS-485 serial bus connector	13	Mounting slot
4	Digital I/O and 24 V power supply	14	Grounding clamp (PE)
5	Analog I/O connector	15	Cable strain relief / PE ground
6	Cable strain relief / PE ground	16	Brake terminal (-81, +82)
7	USB connector	17	Load sharing terminal (DC bus) (-88, +89)
8	Serial bus terminal switch	18	Motor output terminals 96 (U), 97 (V), 98 (W)
9	Analog switches (A53), (A54)	19	Line power input terminals 91 (L1), 92 (L2), 93 (L3)
10	Relay 1 (01, 02, 03)		

1.2 Electrical Installation

This section contains detailed instructions for wiring the adjustable frequency drive. The following tasks are described.

- Wiring the motor to the adjustable frequency drive output terminals
- Wiring the AC line power to the adjustable frequency drive input terminals
- Connecting control and serial communication wiring
- After power has been applied, checking input and motor power; programming control terminals for their intended functions

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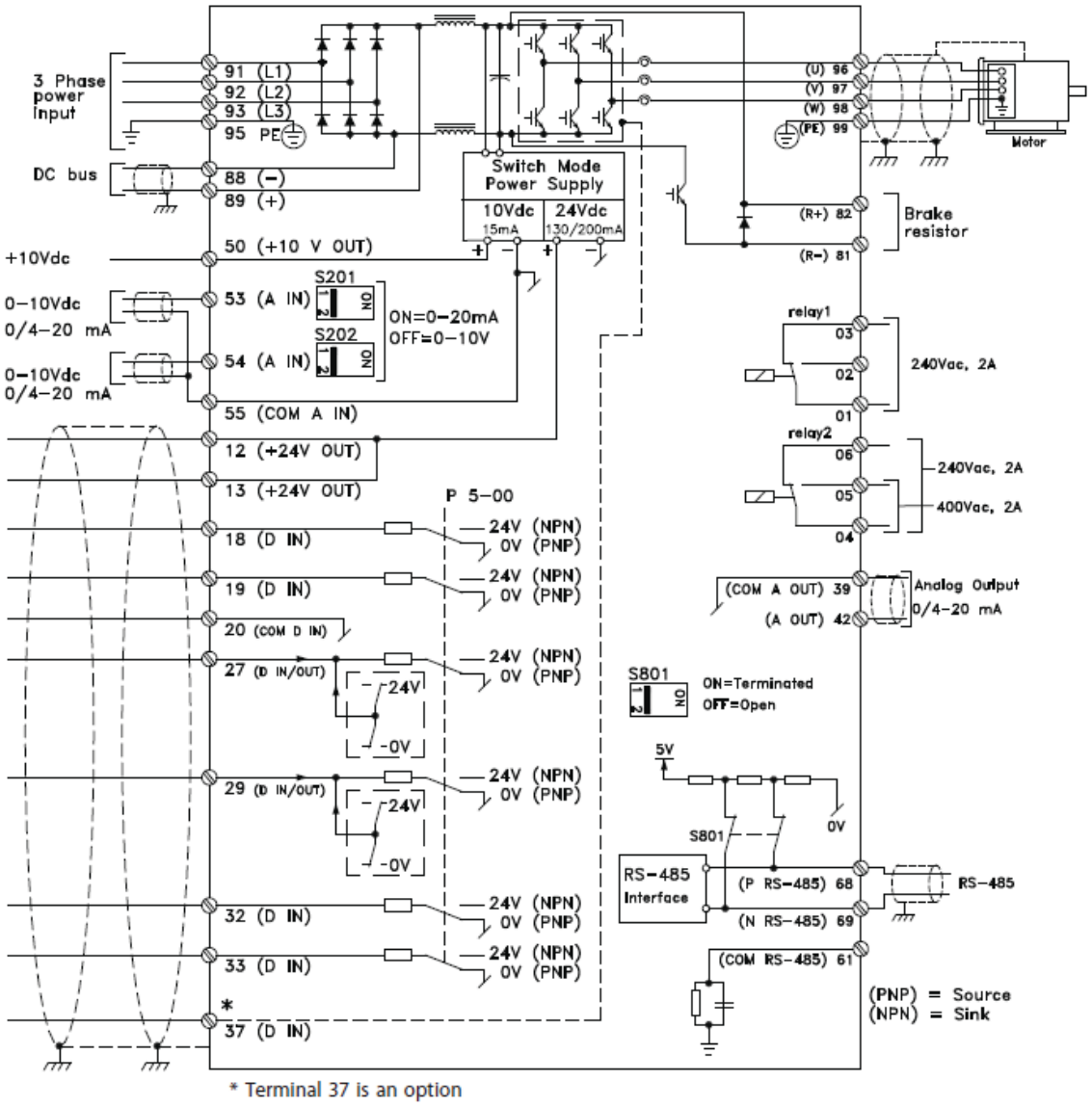
Figure 1-3 shows a basic electrical connection.

Figure 1-3: Basic Wiring Schematic Drawing



DANGER: EQUIPMENT HAZARD! Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. It is strongly recommended that installation, start-up, and maintenance be performed only by trained and qualified personnel. Failure to follow these guidelines could result in death or serious injury.

CAUTION: WIRING ISOLATION! Run input power, motor wiring and control wiring in three separate metallic conduits or use separated shielded cable for high frequency noise isolation. Failure to isolate power, motor and control wiring could result in less than optimum adjustable frequency drive and associated equipment performance.

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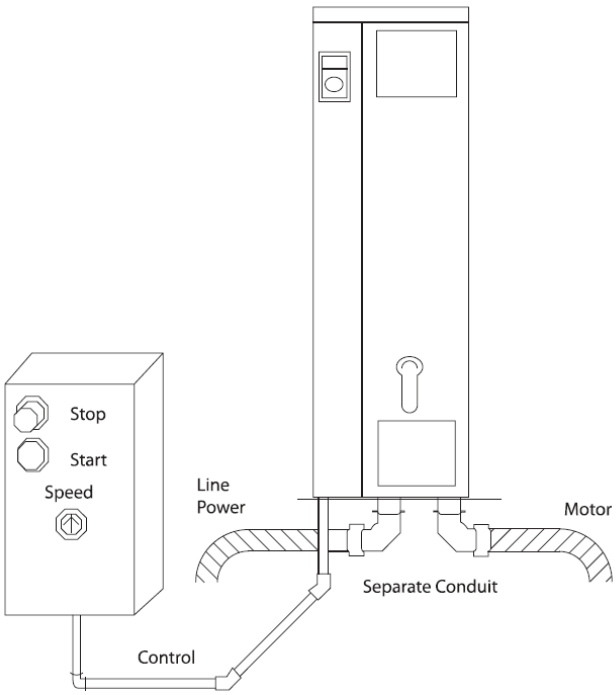
For your safety, comply with the following requirements:

- Electronic controls equipment is connected to hazardous AC line voltage. Extreme care should be taken to protect against electrical hazards when applying power to the unit.
- Run motor cables from multiple adjustable frequency drives separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out.

1.2.1 Overload and Equipment Protection

- An electronically activated function within the adjustable frequency drive provides overload protection for the motor. The overload calculates the level of increase to activate timing for the trip (controller output stop) function. The higher the current draw, the quicker the trip response. The overload provides Class 20 motor protection. See “6 Warnings and Alarms” on page 43 for details on the trip function.
- Because the motor wiring carries high frequency current, it is important that wiring for line power, motor power, and control is run separately. Use metallic conduit or separated shielded wire. Failure to isolate power, motor, and control wiring could result in less than optimum equipment performance. See Figure 1-4.

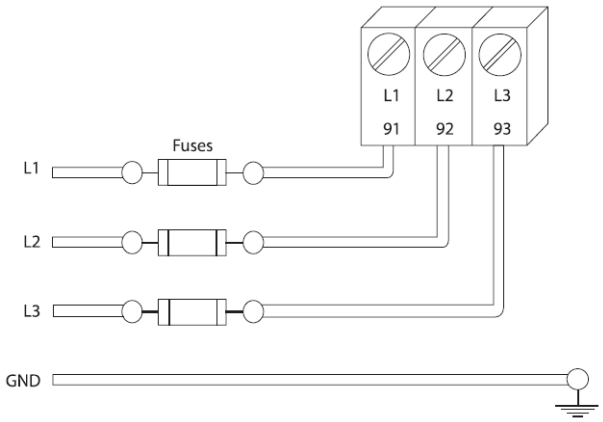
Figure 1-4: Proper Electrical Installation Using Flexible Conduit



- Use the clamps provided with on the equipment for proper ground connections.

All adjustable frequency drives must be provided with short-circuit and overcurrent protection. Input fusing is required to provide this protection, see Figure 9.2.3. If not factory supplied, fuses must be provided by the installer as part of installation.

Figure 1-5: Adjustable Frequency Drive Fuses



Wire Type and Ratings

- All wiring must comply with local and national regulations regarding cross-section and ambient temperature requirements.
- Danfoss recommends that all power connections be made with a minimum 167°F [75 °C] rated copper wire.

1.3 Grounding Requirements

DANGER: GROUNDING HAZARD! For operator safety, it is important to ground adjustable frequency drive properly in accordance with national and local electrical codes as well as instructions contained within these instructions. Ground currents are higher than 3.5 mA. Failure to ground the adjustable frequency drive properly could result in death or serious injury.

NOTE: It is the responsibility of the user or certified electrical installer to ensure correct grounding of the equipment in accordance with national and local electrical codes and standards.

- Follow all local and national electrical codes to ground electrical equipment properly.
- Proper protective grounding for equipment with ground currents higher than 3.5 mA must be established, see *Leakage Current (>3.5 mA)*.
- A dedicated ground wire is required for input power, motor power and control wiring.

- Do not ground one adjustable frequency drive to another in a “daisy chain” fashion.
- Keep the ground wire connections as short as possible.
- Use of high-strand wire to reduce electrical noise is recommended.
- Follow the motor manufacturer wiring requirements.

1.3.1 Leakage Current (>3.5 mA)

Follow national and local codes regarding protective grounding of equipment with a leakage current > 3.5 mA. Adjustable frequency drive technology implies high frequency switching at high power. This will generate a leakage current in the ground connection. A fault current in the adjustable frequency drive at the output power terminals might contain a DC component which can charge the filter capacitors and cause a transient ground current. The ground leakage current depends on various system configurations including RFI filtering, shielded motor cables, and adjustable frequency drive power.

EN/IEC61800-5-1 (Power Drive System Product Standard)

requires special care if the leakage current exceeds 3.5mA.

Grounding must be reinforced in one of the following ways:

- Ground wire of at least 0.0155 in2 [10mm2]
- Two separate ground wires both complying with the dimensioning rules

See EN/IEC61800-5-1 and EN50178 for further information.

1.3.2 Using RCDs

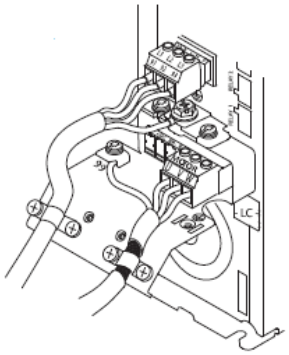
Where residual current devices (RCDs), also known as ground leakage circuit breakers (ELCBs), are used, comply with the following:

- Use RCDs of type B only which are capable of detecting AC and DC currents
- Use RCDs with an inrush delay to prevent faults due to transient ground currents
- Dimension RCDs according to the system configuration and environmental considerations

1.3.3 Grounding Using Shielded Cable

Grounding clamps are provided for motor wiring (see Figure 1-6).

Figure 1-6: Grounding with Shielded Cable

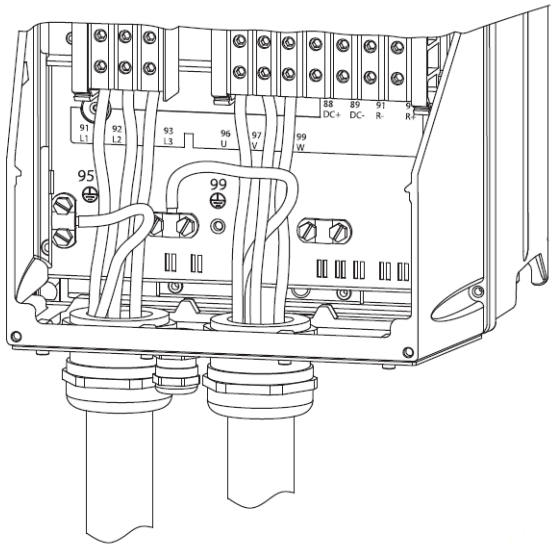


1.3.4 Grounding Using Conduit

DANGER: GROUNDING HAZARD! Do not use conduit connected to the adjustable frequency drive as a replacement for proper grounding. Ground currents are higher than 3.5 mA. Improper grounding can result in personal injury or electrical shorts.

Dedicated grounding clamps are provided (See Figure 1-7).

Figure 1-7: Grounding with Conduit



1. Use a wire stripper to remove the insulation for proper grounding.
2. Secure the grounding clamp to the stripped portion of the wire with the screws provided.
3. Secure the grounding wire to the grounding clamp provided.

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1.3.5 Motor Connection

DANGER: INDUCED VOLTAGE! Run output motor cables from multiple adjustable frequency drives separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output motor cables separately could result in death or serious injury.

- For maximum wire sizes, see “7.1 Power-dependent Specifications” on page 54.
- Comply with local and national electrical codes for cable sizes.
- Motor wiring knockouts or access panels are provided at the base of IP21 and higher (NEMA1/12) units
- Do not install power factor correction capacitors between the adjustable frequency drive and the motor
- Do not wire a starting or pole-changing device between the adjustable frequency drive and the motor.
- Connect the 3-phase motor wiring to terminals 96 (U), 97 (V), and 98 (W).
- Ground the cable in accordance with grounding instructions provided.
- Follow the motor manufacturer wiring requirements

The three following figures represent line power input, motor, and grounding for basic adjustable frequency drives. Actual configurations vary with unit types and optional equipment.

Figure 1-8: Motor, Line Power and Ground Wiring for A-Frame Sizes

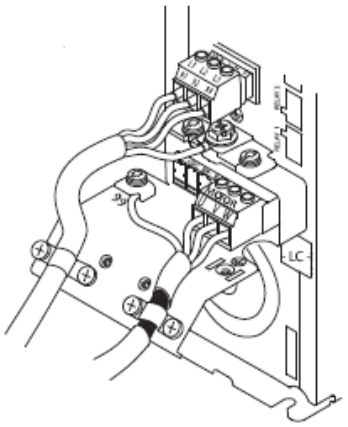


Figure 1-9: Motor, Line Power and Ground Wiring for B-Frame Sizes and Above Using Shielded Cable

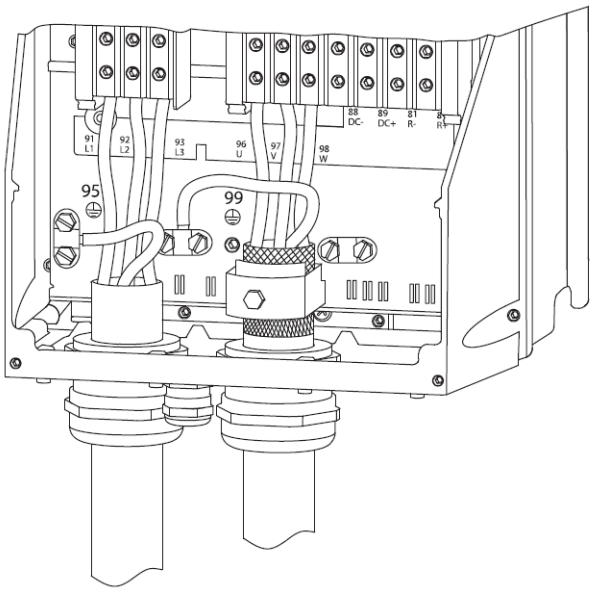
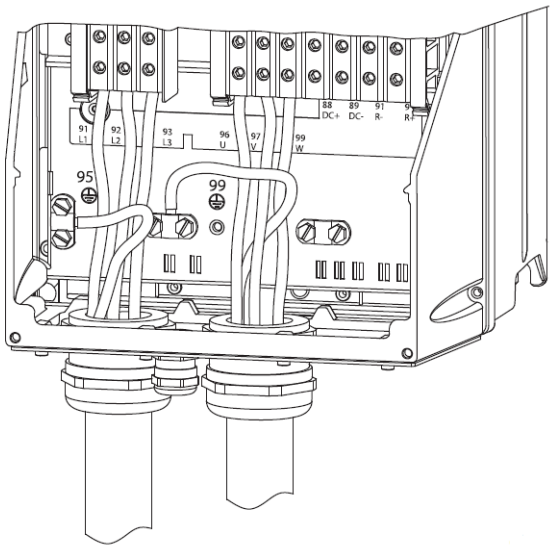


Figure 1-10: Motor, Line Power and Ground Wiring B-Frame Sizes and Above Using Shielded Cable or Conduit



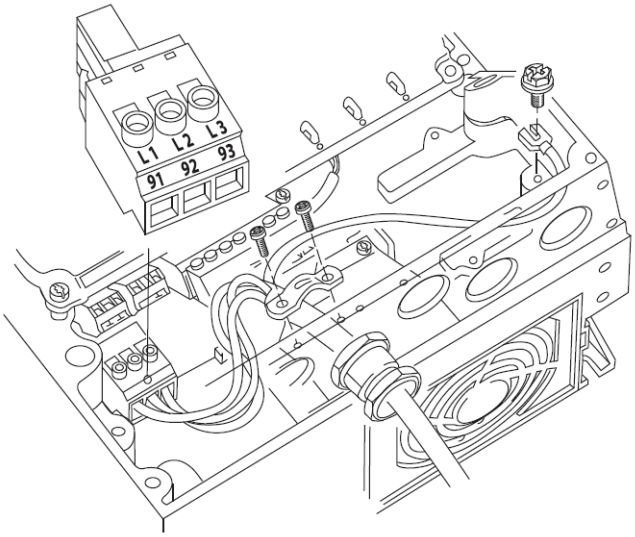
1.3.6 AC Line Power Connection

Size wiring based upon the input current of the adjustable frequency drive.

- Comply with local and national electrical codes for cable sizes.
- Connect 3-phase AC input power wiring to terminals L1, L2, and L3 (see Figure 1-11).

- Depending on the configuration of the equipment, input power will be connected to the line power input terminals or the input disconnect.

Figure 1-11: Connecting to AC Line Power



- Ground the cable in accordance with grounding instructions provided in “1.3 Grounding Requirements” on page 5.
- All adjustable frequency drives may be used with an isolated input source as well as with ground reference power lines. When supplied from an isolated line power source (IT line power or floating delta) or TT/TN-S line power with a grounded leg (grounded delta), set 14-50 RFI 1 to OFF. When off, the internal RFI filter capacitors between the chassis and the intermediate circuit are isolated to avoid damage to the intermediate circuit and to reduce ground capacity currents in accordance with IEC 61800-3.

1.3.7 Control Wiring

Isolate control wiring from high power components in the adjustable frequency drive.

If the adjustable frequency drive is connected to a thermistor, for PELV isolation, optional thermistor control wiring must be reinforced/ double insulated. A 24 VDC supply voltage is recommended.

Access

Remove access cover plate with a screwdriver. See “Figure 1-12: Control Wiring Access for A2, A3, B3, B4, C3 and C4 Enclosures” on page 8.

Or remove front cover by loosening attaching screws. See “Figure 1-13: Control Wiring Access for A4, A5, B1, B2, C1 and C2 Enclosures” on page 8.

Figure 1-12: Control Wiring Access for A2, A3, B3, B4, C3 and C4 Enclosures

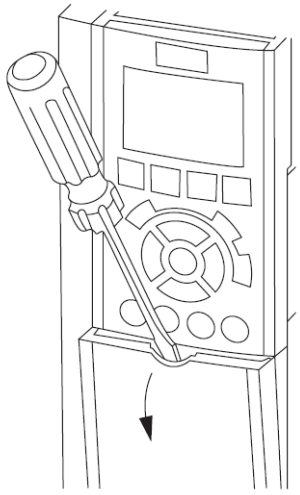
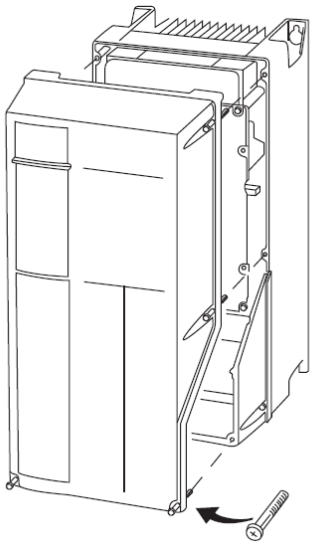


Figure 1-13: Control Wiring Access for A4, A5, B1, B2, C1 and C2 Enclosures



Please see the table below before tightening the covers.

Table 1: Tightening Torques for Covers (Nm)

Frame	IP20	IP21	IP55	IP66
A4/A5	-	-	2	2
B1	-	*	2.2	2.2
B2	-	*	2.2	2.2
C1	-	*	2.2	2.2
C2	-	*	2.2	2.2
* No screws to tighten - Does not exist				

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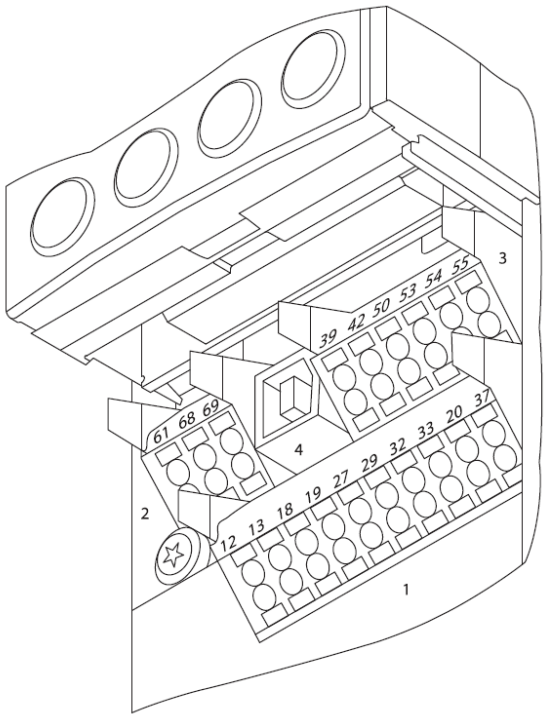
Control Terminal Types

Figure 1-14 shows the removable adjustable frequency drive connectors.

Figure 1-14: Control Terminal Locations

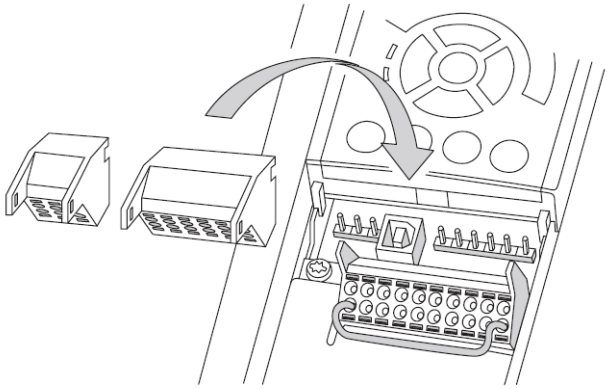


- Connector 1 provides the drive's ability to alternate and perform the lead/lag function. Four programmable digital inputs terminals, two additional digital terminals programmable as either input or output, a 24V DC terminal supply voltage, and a common for optional customer supplied 24V DC voltage.
- Connector 2 terminals (+)68 and (-)69 are for an RS-485 serial communications connection. This connection is not needed unless you wish to provide information back to a building management system (BMS).
- Connector 3 provides the connection points for the sensor/s feedback to the drives. It offers two analog inputs, one analog output, 10V DC supply voltage, and commons for the inputs and output.
- Connector 4 is a USB port available for use with the MCT-10 Set-up Software. This feature aids in setup or troubleshooting programing problems.
- Also provided are two Form C relay outputs that are in various locations depending upon the adjustable frequency drive configuration and size. Relay 1 is used for all programs.

Wiring to Control Terminals

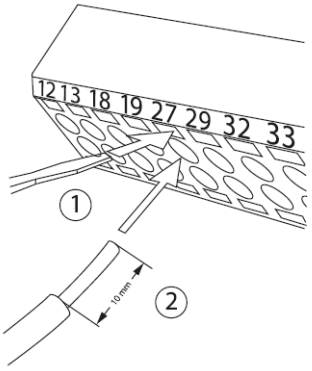
Control terminal connectors can be unplugged from the adjustable frequency drive for ease of installation, as shown in Figure 1-15.

Figure 1-15: Unplugging Control Terminals



1. Open the contact by inserting a small screwdriver into the slot above or below the contact, as shown in Figure 1-16.
2. Insert the bared control wire into the contact.
3. Remove the screwdriver to fasten the control wire into the contact.
4. Ensure the contact is firmly established and not loose. Loose control wiring can be the source of equipment faults or less than optimal operation.

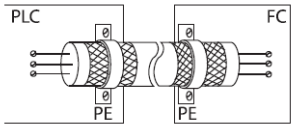
Figure 1-16: Connecting Control Wiring



Using Shielded Control Cables

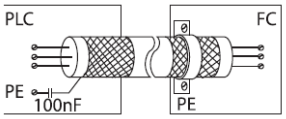
Correct Shielding

The preferred method in most cases is to secure control and serial communication cables with shielding clamps provided at both ends to ensure best possible high frequency cable contact.



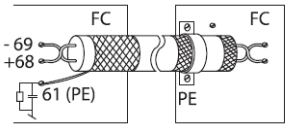
50/60 Hz ground loops

With very long control cables, ground loops may occur. To eliminate ground loops, connect one end of the shield to ground with a 100 nF capacitor (keeping leads short).



Avoid EMC noise on serial communication

To eliminate low-frequency noise between adjustable frequency drives, connect one end of the shield to terminal 61. This terminal is connected to ground via an internal RC link. Use twisted-pair cables to reduce interference between conductors.



Control Terminal Functions

Adjustable frequency drive functions are commanded by receiving control input signals.

- Each terminal must be programmed for the function it will be supporting in the parameters associated with that terminal.
- It is important to confirm that the control terminal is programmed for the correct function. See “2 User Interface” on page 12for details on accessing parameters.
- The default terminal programming is intended to initiate adjustable frequency drive functioning in a typical operational mode.

Terminal 53 and 54 Switches

- Analog input terminals 53 and 54 can select either voltage (0 to 10V) or current (4–20mA) input signals
- Remove power to the adjustable frequency drive before changing switch positions.
- Set switches A53 and A54 to select the signal type. U selects voltage, I selects current. Drives from Taco are already selected for voltage.
- The switches are accessible when the LCP has been removed. Note that some option cards available for the unit may cover these switches and must be removed to change switch settings. Always remove power to the unit before removing option cards.
- Terminal 53 default is for the supply line sensor for delta T, or 2nd pressure sensor input for delta P.
- Terminal 54 default is the return line sensor for delta T program, or 1st pressure sensor input for delta P.

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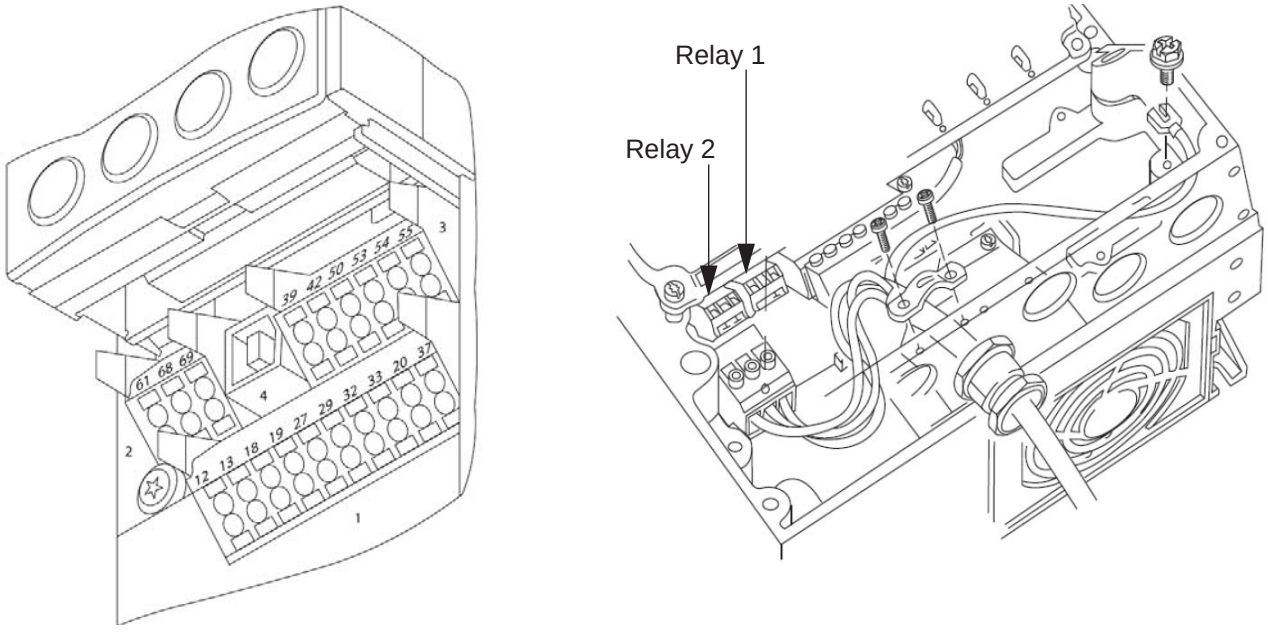
1.4 Typical Terminal Wiring Configurations

The unit connection blocks are shown in “Figure 1-14: Control Terminal Locations” on page 9.

Table 2: Control Terminal Information

	Terminal number	Description
Relay Outputs	01, 02, 03	Form C Relay Output. Used for AC or DC voltages and either resistive or inductive loads. see the following section on relay wiring for contact current and voltage ratings.
	04, 05, 06	
Connector 1	12, 13	24 V DC supply voltage. Maximum output current is 200 mA total for all 24 V loads. Intended for digital inputs, external transducers.
	18	Start/Stop digital input signal for the drive.
	19	Digital input (used)
	27	Digital output (used)
	29	Digital input/output (used)
	32	Digital input (used)
	33	Digital input (used)
	20	Common for digital inputs and reference for 24 V supply
Connector 2	61	Integrated RC filter for cable shield. ONLY for connecting the shield when experiencing EMC problems.
	68	RS485 Interface (+)
	69	RS485 Interface (-)
Connector 3	39	Common for analog output
	42	Analog output. Default setting is 4-20mA signal (500 ohms maximum) based on motor speed.
	50	10 V DC analog supply voltage. 15mA max.
	53	Analog input 53.
	54	Analog input 54.
	55	Common for analog input.

Figure 1-17: Control Terminal Connectors 1-4 and Relay Output Locations



2 USER INTERFACE

2.1 Local Control Panel

The local control panel (LCP) is the combined display and keypad on the front of the unit. The LCP is the user interface to the adjustable frequency drive.

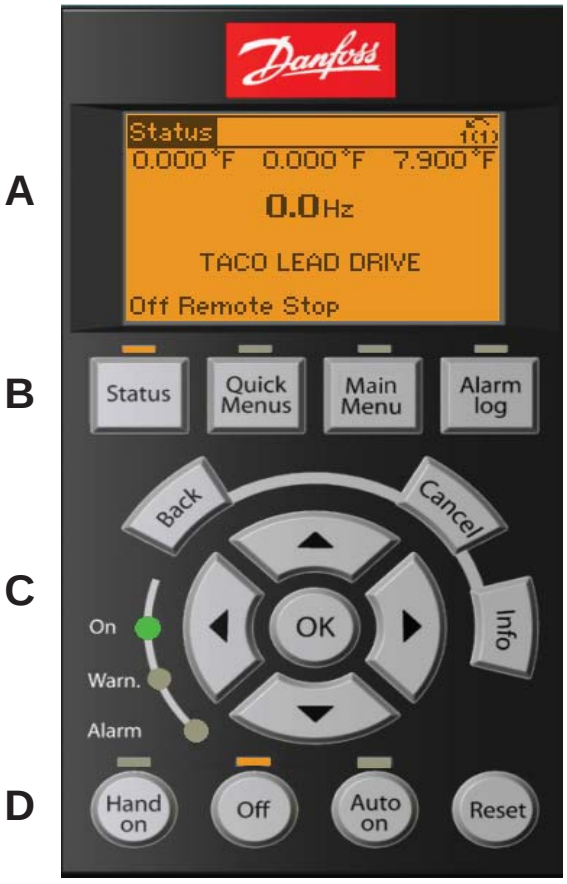
The LCP has several user functions.

- Start, stop, and control speed when in local control
- Display operational data, status, warnings and cautions
- Programming adjustable frequency drive functions
- Manually reset the adjustable frequency drive after a fault when auto-reset is inactive

LCP Layout

The LCP is divided into four functional groups (see Figure 2-1).

Figure 2-1: LCP



a. Display area
b. Display menu keys for changing the display to show status options, programming, or error message history.
c. Navigation keys for programming functions, moving the display cursor, and speed control in local operation. Also included are the status indicators.
d. Operational mode keys and reset.

Setting LCP Display Values

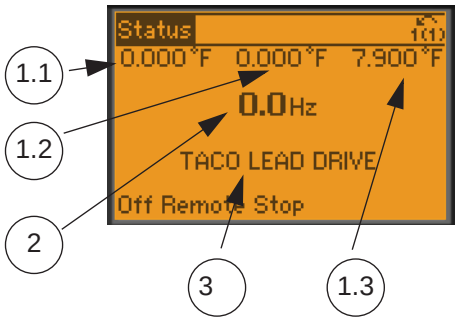
The display area is activated when the adjustable frequency drive receives power from AC line voltage, a DC bus terminal, or an external 24V supply.

The information displayed on the LCP can be customized for user application.

- Each display readout has a parameter associated with it.
- Options are selected in the quick menu *Q3-13 Display Settings*.
- Display 2 has an alternate larger display option.
- The adjustable frequency drive status at the bottom line of the display is generated automatically and is not selectable.

Display	Parameter number	Default setting
1.1	0-20	Reference
1.2	0-21	Feedback 1 dP / Supply dT
1.3	0-22	Feedback 2 dP / Return dT
2	0-23	Frequency
3	0-24	Drive Status

Figure 2-2: Status Display



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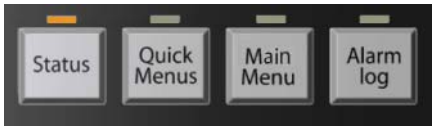
Display Menu Keys

Menu keys are used for menu access for parameter set-up, toggling through status display modes during normal operation, and viewing fault log data.

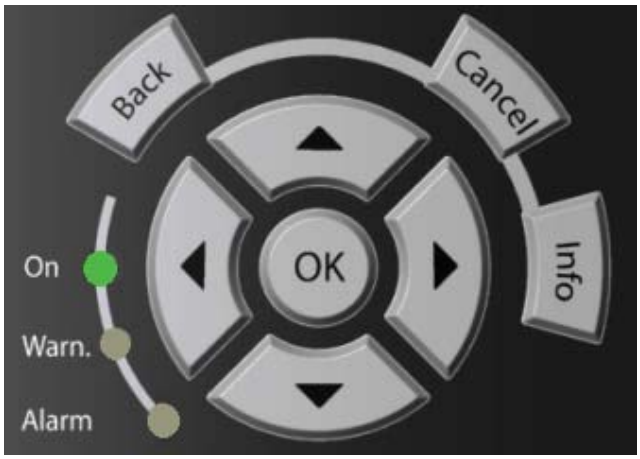


Key	Function
Status	Press to show operational information. • In Auto mode, press and hold to toggle between status readout displays. • Press repeatedly to scroll through each status display. • Press and hold [Status] plus [▲] or [▼] to adjust the display brightness. • The symbol in the upper right corner of the display shows the direction of motor rotation and which set-up is active. This is not programmable.
Quick Menu	Allows access to programming parameters for initial set-up instructions and many detailed application instructions. • Press to access *Q2 Quick Set-up* for sequenced instructions to program the basic adjustable frequency drive set-up. • Press to access *Q3 Function Set-ups* for sequenced instructions to program applications • Follow the sequence of parameters as presented for the function set-up.
Main Menu	Allows access to all programming parameters. • Press twice to access top level index. • Press once to return to the last location accessed. • Press and hold to enter a parameter number for direct access to that parameter.
Alarm Log	Displays a list of current warnings, the last 10 alarms, and the maintenance log. • For details about the adjustable frequency drive before it entered the alarm mode, select the alarm number using the navigation keys and press [OK].

Navigation Keys

Navigation keys are used for programming functions and moving the display cursor. The navigation keys also provide speed control in local (hand) operation. Three adjustable frequency drive status indicators are also located in this area.

Figure 2-3: Navigation Keys



Key	Function
Back	Reverts to the previous step or list in the menu structure.
Cancel	Cancels the last change or command as long as the display mode has not changed.
Info	Press for a definition of the function being displayed.
Navigation Keys	Use the four navigation arrows to move between items in the menu.
OK	Use to access parameter groups or to enable a choice.

Figure 2-4: Indicator Lights

Light	Indicator	Function
Green	ON	The ON light activates when the adjustable frequency drive receives power from AC line voltage, a DC bus terminal, or an external 24 V supply.
Yellow	WARN	When warning conditions are met, the yellow WARN light comes on and text appears in the display area identifying the problem.
Red	ALARM	A fault condition causes the red alarm light to flash and an alarm text is displayed.

Operation Keys

Operation keys are found at the bottom of the control panel.

Figure 2-5: Operation Keys

Key	Function
Hand On	Press to start the adjustable frequency drive in local control. • Use the navigation keys to control adjustable frequency drive speed. • An external stop signal by control input or serial communication overrides the local hand on.
Off	Stops the motor but does not remove power to the adjustable frequency drive.
Auto On	Puts the system in remote operational mode. • Responds to an external start command by control terminals or serial communication • Speed reference is from an external source
Reset	Resets the adjustable frequency drive manually after a fault has been cleared.

2.2 Backup and Copying Parameter Settings

Programming data is stored internally in the adjustable frequency drive.

- The data can be uploaded into the LCP memory as a storage backup.
- Once stored in the LCP, the data can be downloaded back into the adjustable frequency drive.
- Initialization of the adjustable frequency drive to restore factory default settings does not change data stored in the LCP memory.

DANGER: UNINTENDED START! When adjustable frequency drive is connected to AC line power, the motor may start at any time. The adjustable frequency drive, motor, and any driven equipment must be in operational readiness. Failure to be in operational readiness when the adjustable frequency drive is connected to AC line power could result in death, serious injury, equipment, or property damage.

Uploading Data to the LCP

1. Press [OFF] to stop the motor before uploading or downloading data.
2. Go to *0-50 LCP Copy*.
3. Press [OK].
4. Select All to LCP.
5. Press [OK]. A progress bar shows the uploading process.
6. Press [Hand On] or [Auto On] to return to normal operation.

Downloading Data from the LCP

1. Press [OFF] to stop the motor before uploading or downloading data.
2. Go to *0-50 LCP Copy*.
3. Press [OK].
4. Select All from LCP.
5. Press [OK]. A progress bar shows the downloading process.
6. Press [Hand On] or [Auto On] to return to normal operation.

Restoring Default Settings

CAUTION: Initialization restores the unit to factory default settings. Any programming, motor data, localization, and monitoring records will be lost. Uploading data to the LCP provides a backup prior to initialization.

Restoring the adjustable frequency drive parameter settings back to default values is done by initialization of the adjustable frequency drive. Initialization can be through *14-22 Operation Mode* or manually.

- Initialization using *14-22 Operation Mode* does not change adjustable frequency drive data such as operating hours, serial communication selections, personal menu settings, fault log, alarm log, and other monitoring functions.
- Using *14-22 Operation Mode* is generally recommended.
- Manual initialization erases all motor, programming, localization, and monitoring data and restores factory default settings.

Recommended Initialization

1. Press [Main Menu] twice to access parameters.
2. Scroll to 14-*22 Operation Mode*.
3. Press [OK].
4. Scroll to Initialization.
5. Press [OK].
6. Remove power to the unit and wait for the display to turn off.

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7. Apply power to the unit. Default parameter settings are restored during start-up. This may take slightly longer than normal.
8. Press [Reset] to return to operation mode.

Manual Initialization

1. Remove power to the unit and wait for the display to turn off.
2. Press and hold [Status], [Main Menu], and [OK] at the same time and apply power to the unit.

Factory default parameter settings are restored during start-up. This may take slightly longer than normal.

Manual initialization does not reset the following adjustable frequency drive information:

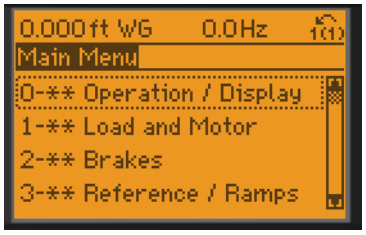
- *15-00 Operating Hours*
- *15-03 Power-ups*
- *15-04 Over Temps*
- *15-05 Over Volts*

2.3 Password Protection

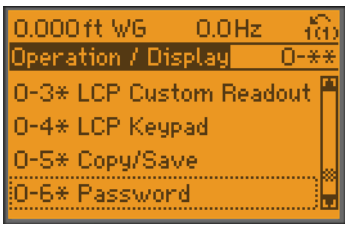
2.3.1 Enable Password Protection for Main Menu

1. Press [Main Menu].

2. Select *0-** Operation / Display* by pressing [OK].



3. Scroll Down to parameter *0-6* Password*.



4. Press [OK].

5. Scroll down to parameter *0-61 Access to Main Menu w/o Password*.

6. Press [OK].

7. Change parameter *0-61* to "[2] LCP: No Access."

8. Press [OK].

The Main Menu is now password protected. The default password is 100.

2.3.2 Disable Main Menu Password

1. Follow steps 1-6 in section 2.3.1 above.
2. Change parameter *0-61* to "[0] Full Access."

3. Press [OK].

The Main Menu Password is now disabled.

2.3.3 Change Password for Main Menu

1. Follow steps 1-4 in section 2.3.1 above.
2. Scroll down to parameter *0-60 Main Menu Password*.

3. Press [OK].

4. Adjust/Edit the password using the arrow keys.

5. Press [OK].

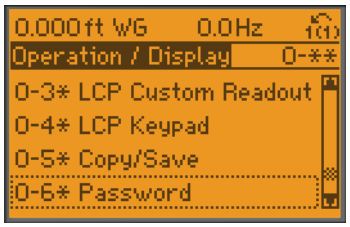
The Main Menu password is now changed.

2.3.4 Enable Password Protection for My Personal Menu

1. Press [Main Menu].

2. Select *0-** Operation / Display* by pressing [OK].

3. Scroll Down to parameter *0-6* Password*.



4. Press [OK].

5. Scroll down to parameter *0-66 Access to Personal Menu w/o Password*.

6. Press [OK].

7. Change parameter *0-66* to “[1] LCP: Read Only.”

8. Press [OK].

The My Personal Menu is now password protected. The default password is 200.

2.3.5 Disable Password Protection for My Personal Menu

1. Follow steps 1-3 in section 2.3.4 above.
2. Change parameter *0-66* to “[0] Full Access.”
3. Press [OK].

The Personal Menu password protection is now disabled.

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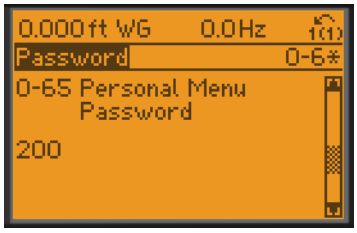
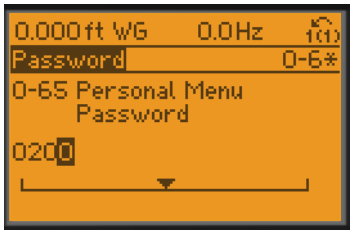
2.3.6 Change Password for Personal Menu

1. Follow steps 1-4 in section 2.3.4 above.
2. Scroll down to parameter *0-65 Personal Menu Password*.



3. Press [OK].

4. Adjust/Edit the password using the arrow keys.



5. Press [OK].

The Personal Menu Password is now changed.

3 PUMP CONTROL SET-UPS

3.1 Taco System Logic Description

The Taco System Logic pump is a Taco pump equipped with a Danfoss variable frequency drive (VFD) that has the ability to run a delta T or delta P system without the need of a building management system. We use the same technology that is in our SelfSensing line. This allows for a one touch startup on the job site, with the purchase of a Taco sensor. The whole system will arrive at the job site and allow for an easy and quick installation.

These programs enable the pump to continuously identify the system needs at any point in time, giving accurate pressure or temperature control without the need for a BMS. Patented software technology within the controller ensures trouble-free operation in all conditions.

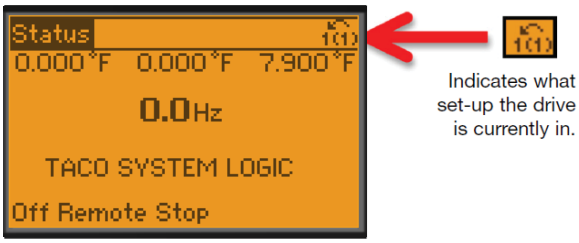
3.2 Set-up Menu

The controller has 4 different set-ups to determine the drive's responsibility:

Set-up	Description	Instructions
Set-up 1 	Lead pump	Section
Set-up 2 	Standby / Lag pump 1	Section
Set-up 3 	Standby / Lag pump 2	Section
Set-up 4 	Alarm mode	Section

3.2.1 Set-up Confirmation

To confirm the current setup, view the display.



1(1) indicates Setup 1.

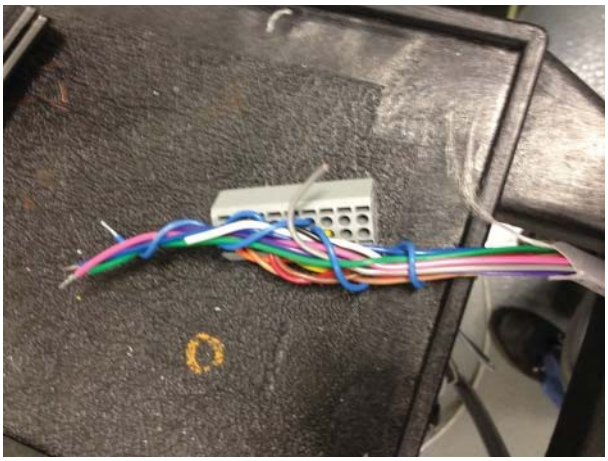
2(2) indicates Setup 2.

3(3) indicates Setup 3.

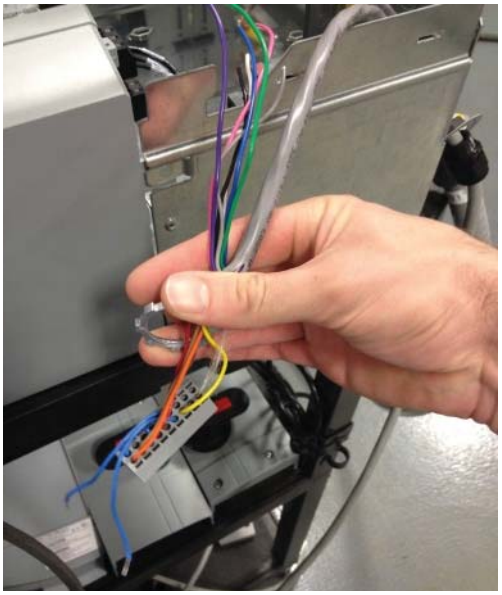
3.3 Installation Instructions for CRB and CRH

1. Place connector and loose wires through the punched-out hole. It is recommended that you start with the biggest connector first and go from largest to smallest.

   NOTE: when placing the connectors through the hole, make sure to keep wires straight and compressed onto connector to avoid wires snagging on any sharp corners.



2. Once all the wiring is through the punched-out hole, proceed to place the wiring through the conduit nut. Follow the same procedure, starting with the largest connector first and working your way down to the smallest connector and loose wires.



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3. Plug in the 10-pin connector to the ten pins at the bottom of drive.
4. Connect relay 1. The connection is located below the 10-pin connector on the bottom of the drive, next to the motor wiring connection.

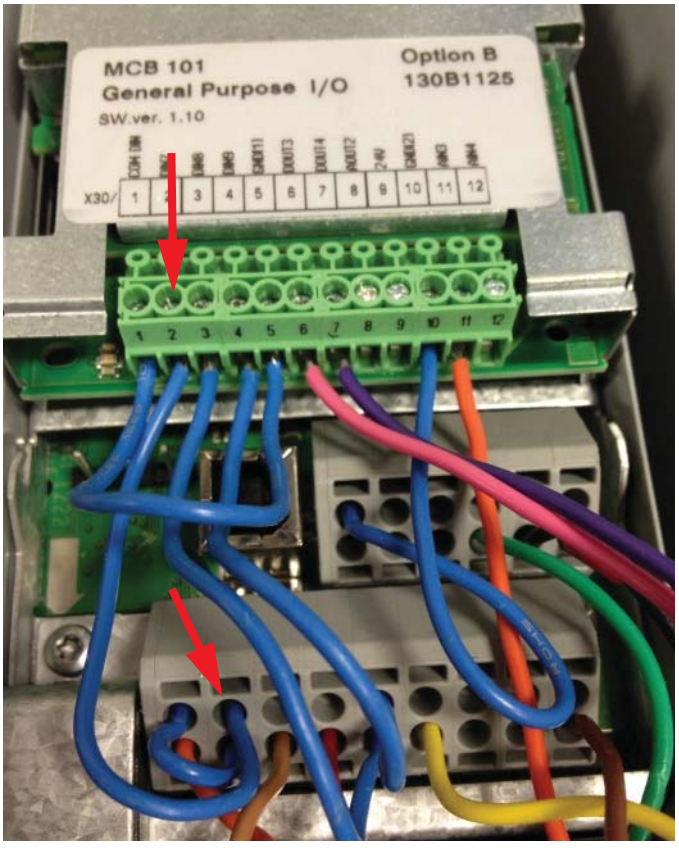
   NOTE: If you are connecting a CRH, the installation is complete at this time. Customers who ordered a 3-drive application (CRB) must perform the following procedures as well.

5. Connect the remaining wires to the MCB101 communication card on the drive.
   a. First remove the LCD display on the drive along with the plastic molding that holds it in.
   b. To remove the bracket, simply press down on the back where you see the finger in the picture, and pull up as if the bottom of the bracket is on a hinge.

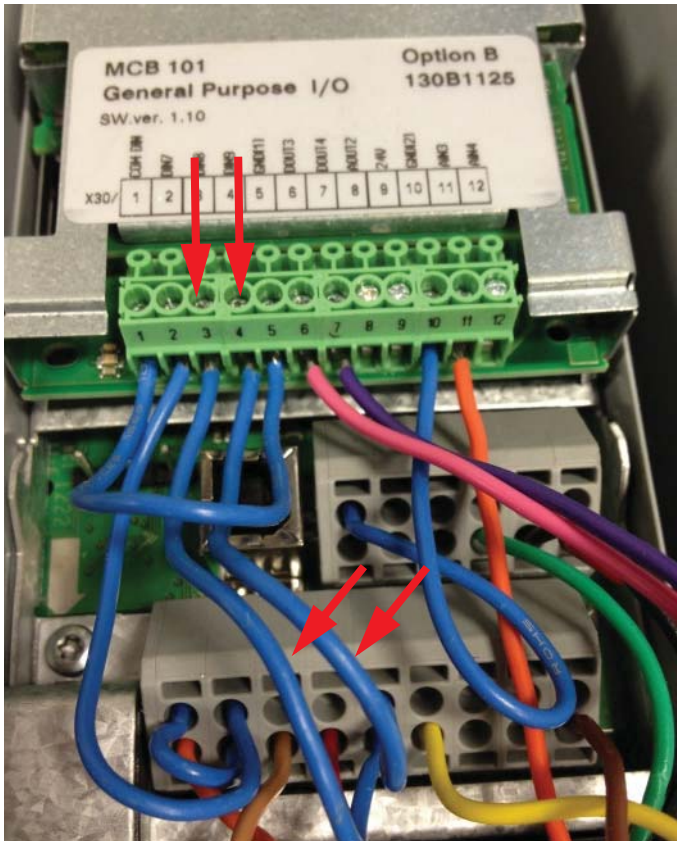
Once the top of the bracket is unhooked, you can just lift up the bracket.

c. The MCB 101 communication card is already plugged into the drive from the factory.

6. The loose 3” blue wire (#110, 210, or 310) from position 13 on the 10-pin connector must be connected to the communication card (MCB101) X30-2 position.



7. The (2) loose 3” Blue wires (#115, 215, or 315) from position 27 on the 10-pin connector must be connected to the communication card (MCB101) X30-3 and X30-4 positions.



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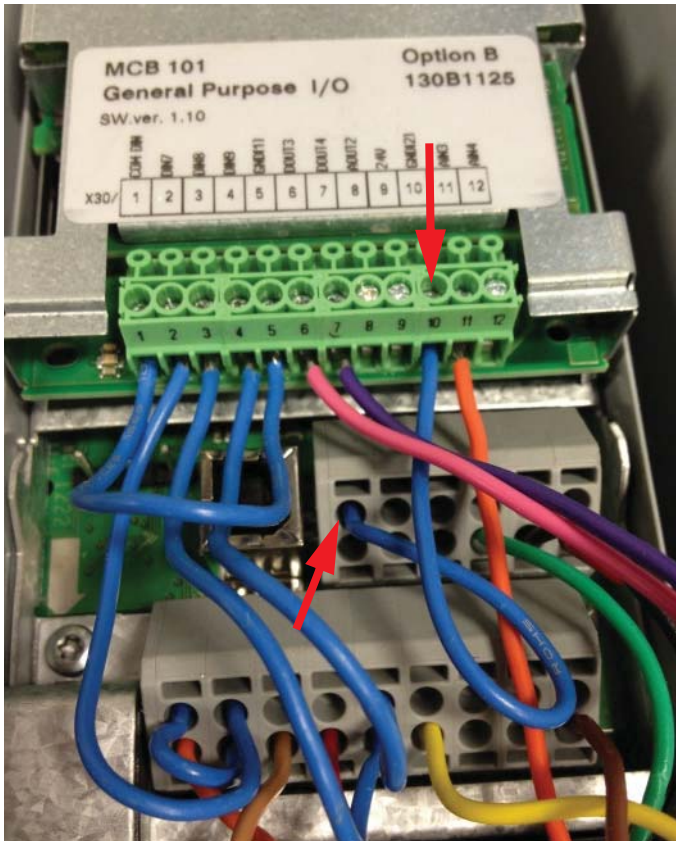
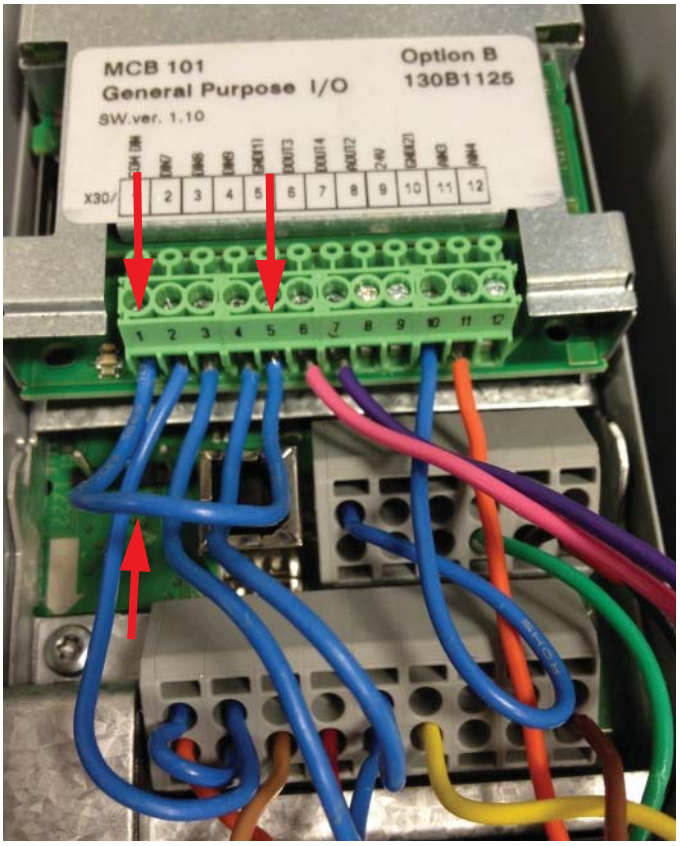
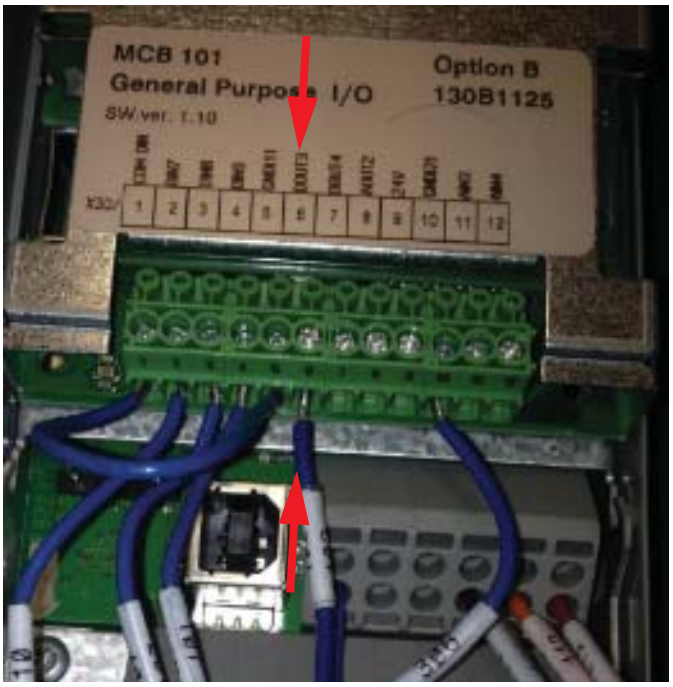
8. Connect the 3” blue wire (#118, 218, or 318) and connect it from position 39 on the 6-pin connector to the communication card (MCB101) X30-10 position.



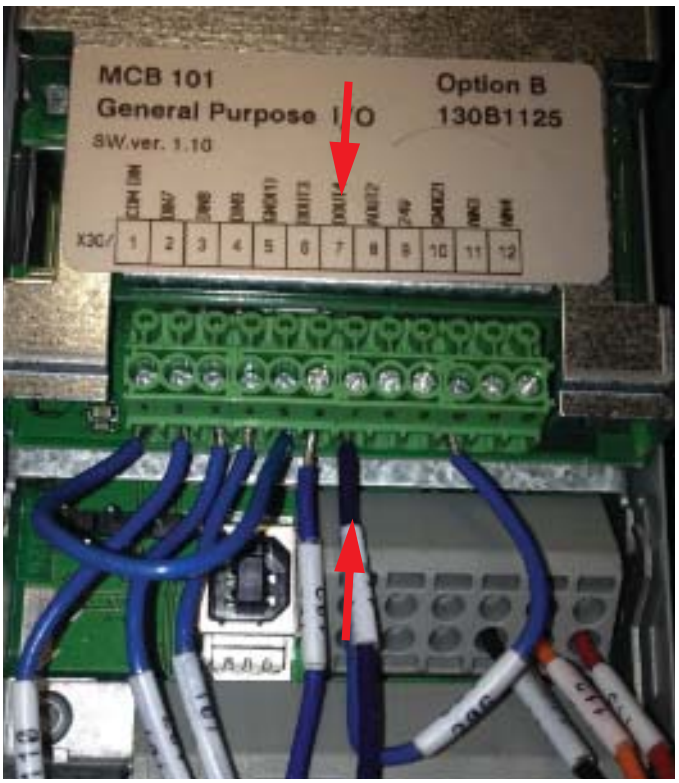
9. Make sure the 3” blue wire (#122, 222, or 322) is connected to the communication card (MCB101) X30-1 position to the communication card (MCB101) X30-5 position. This process is done in the factory.



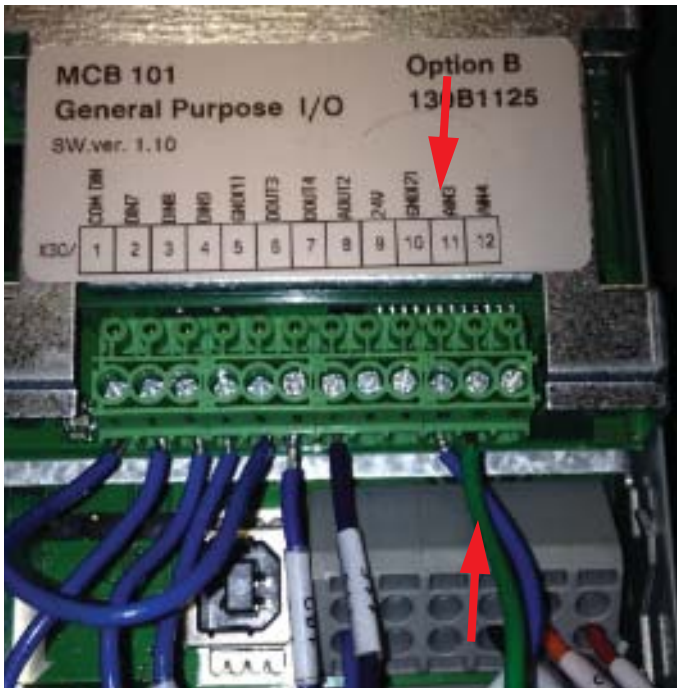
10. For drive 1 and drive 2 you must connect 2 extra wires for each.
    a. Connect the long blue wire (#123 or #223) to the communication card (MCB101) X30-6 position.



    b. Connect the purple wire (#124 or #224) to the communication card (MCB101) position X30-7.



11. If you are using a 3rd sensor for the delta P program, connect the last remaining wire (green, #125) to the position X30-11 on all three drives.



12. Secure extra wire to drives and tuck any remaining wire into the drive or CRBox.

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Table 3: Wire Connections for 3 Drive TSL

Drive 1 Connections

Wire Number	Color	Position
101	Yellow	20
110	Black	12
110	Green	2
112	Brown	18
113	Red	19
115	Blue	27
115	Blue	3 to 4
116	Orange	29
118	Blue	39
118	Blue	10
119	Black	53
120	Orange	54
121	Red	55
122	Blue	1 to 5
123	Blue	6
124	Purple	7
125	Green	11

Drive 2 Connections

Wire Number	Color	Position
201	Yellow	20
210	Black	12
210	Green	2
212	Brown	18
213	Red	19
215	Blue	27
215	Blue	3 to 4
216	Orange	29
217	Blue	39
218	Blue	10
219	Black	53
220	Orange	54
221	Red	55
222	Blue	1 to 5
223	Blue	6
224	Purple	7
225	Green	11

Drive 3 Connections

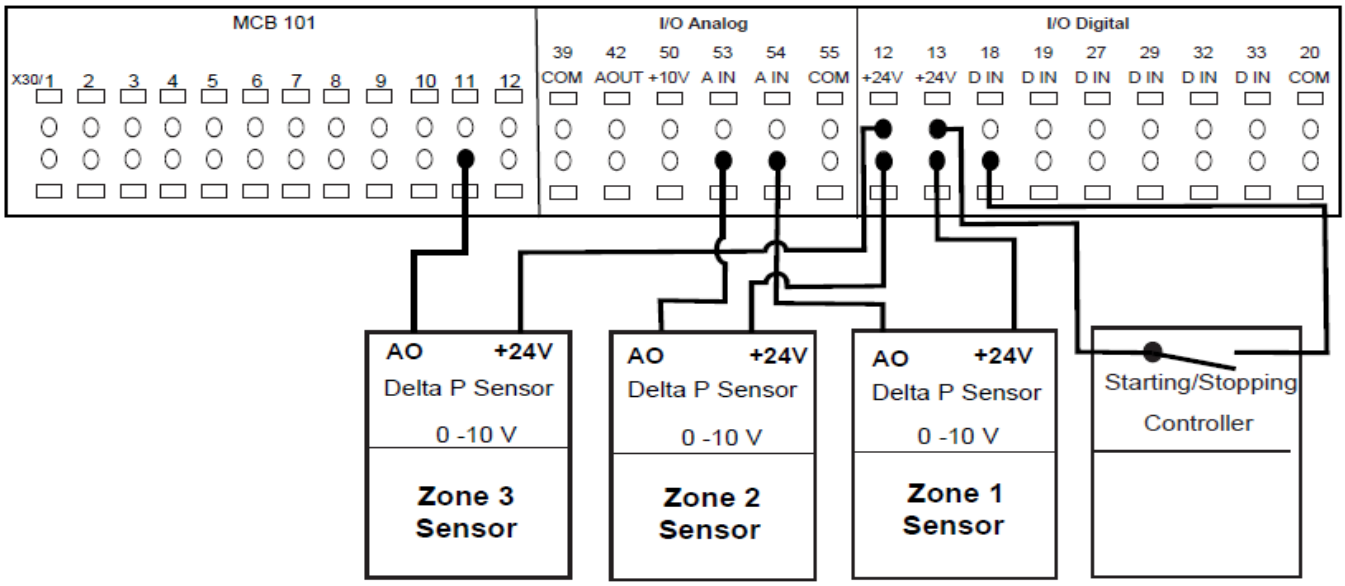
Wire Number	Color	Position
301	Yellow	20
310	Black	12
310	Green	2
312	Brown	18
313	Red	19
315	Blue	27
315	Blue	3 to 4
316	Orange	29
317	Blue	39
318	Blue	10
319	Black	53
320	Orange	54
321	Red	55
322	Blue	1 to 5
323	Blue	6
324	Purple	7
325	Green	11

3.4 Installation of Sensors for a 2-Drive Setup

3.4.1 Installation of Pressure Sensor

This configuration adds a transducer for closed loop or external monitoring. Teminals 54 is for the zone 1 sensor, terminal 53 is for the zone 2 sensor, and terminal 11 on the MCB101 Card is for a zone 3 sensor. Terminal 55 corresponds to the common if using a 3 wire sensor.

Figure 3-1: Terminal Wiring for 0-10V Delta P Sensor



To configure the controller for closed loop control based on the input from an external transducer, use the following parameters:

Table 4: Setting up parameters for a Delta P Sensor

Parameter number	Description	to
6-14	Terminal 53 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0. For live 0 function set feedback to 1V or 10 PSI Note: Live 0 does not work ifminimum is set to 0.
6-15	Terminal 53 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–100 PSI transducer, set to 100.
6-17	Terminal 53 Live Zero	Enabled
6-24	Terminal 54 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0. For live 0 function set feedback to 1V or 10 PSI Note: Live 0 does not work ifminimum is set to 0.
6-25	Terminal 54 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–100 PSI transducer, set to 100.
6-27	Terminal 54 Live Zero	Enabled
20-00	Feedback 1 Source	Analog Input 54
20-03	Feedback 2 Source	Analog Input 53
20-12	Reference/Feedback	Set as appropriate for application. For example, set to PSI when using a pressure transducer. The default value for this setting is PSI.
20–13	Min Reference/Feed-back	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0 PSI.
20–14	Max Reference/Feed-back	Maximum transducer input value. For example, for a 100 PSI transducer, set to 100 PSI.

3.4.2 Installation of Temperature Sensors

This configuration adds a temperature sensor for the Taco System Logic Program. Terminal 54 temperature sensor is to be connected to the return line and terminal 53temperature sensor is to be connected to the supply line.

Figure 3-2: Terminal wiring for 0-10V Temperature Sensors

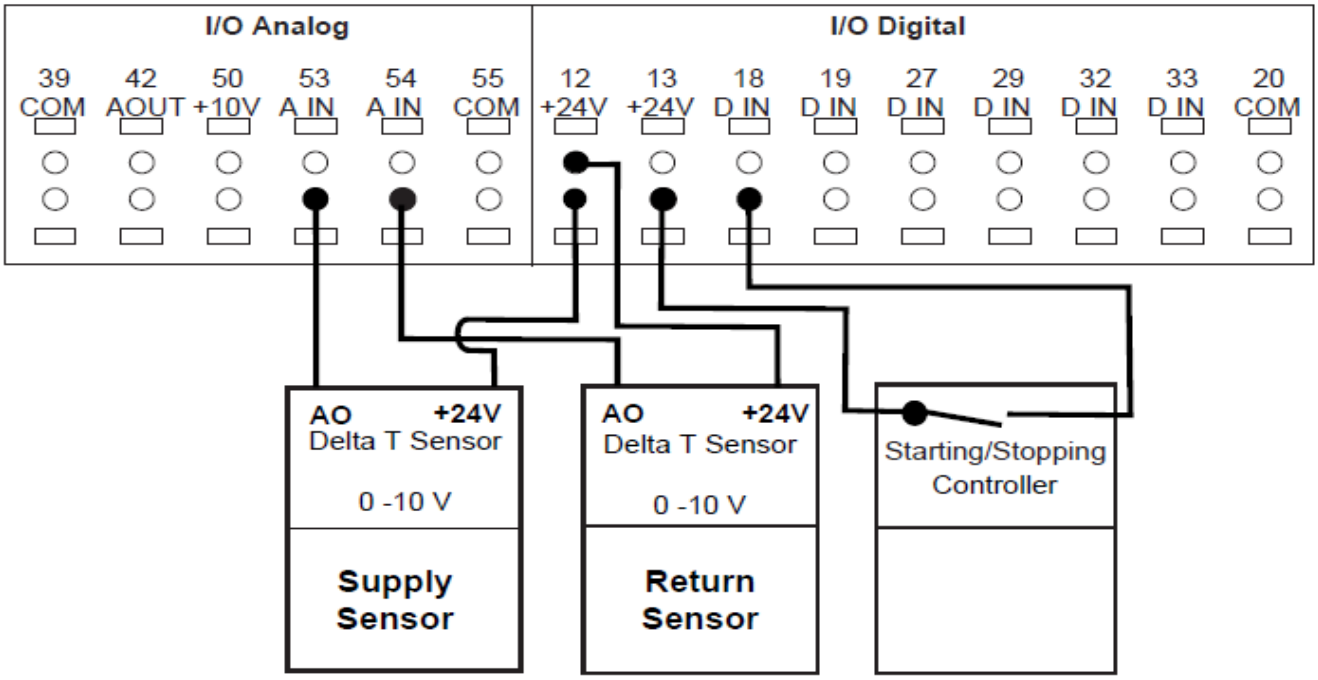


Table 5: Setting Parameters for a Delta T Sensor

Parameter number	Description	to
6-14	Terminal 53 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0. For live 0 function set feedback to 1V or 25°F Note: Live 0 does not work ifminimum is set to 0.
6-15	Terminal 53 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–250°F transducer, set to 250.
6-17	Terminal 53 Live Zero	Enabled
6-24	Terminal 54 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0. For live 0 function set feedback to 1V or 25°F Note: Live 0 does not work if minimum is set to 0.
6-25	Terminal 54 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–250°F transducer, set to 250.
6-27	Terminal 54 Live Zero	Enabled
20-00	Feedback 1 Source	Analog Input 54
20-03	Feedback 1 Source	Analog Input 53
20-12	Reference/Feedback	Set as appropriate for application. For example, set to °F when using a Temperature transducer. The default value for this setting is °F.
20–13	MinReference/Feed-back	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0 °F.
20–14	Max Reference/Feed-back	Maximum transducer input value. For example, for a 250 °F transducer, set to 250°F.

3.5 Installation of a Sensor for a 3-Drive Setup

3.5.1 Installation of Pressure Sensor

This configuration adds a transducer for closed loop or external monitoring. On terminal strip 3 (TS3), Feedback 1 (FB1) is for the zone 1 pressure sensor, FB2 is for the zone 2 pressure sensor, and FB3 is for the zone 3 pressrue sensor. For sensors with a common wire use FBCOM on terminal strip 1 (TS1). The Delta P sensors will be powered by a 24V output from teminal 12.

Figure 3-3: Three Drive Terminal Wiring for Delta P Sensor

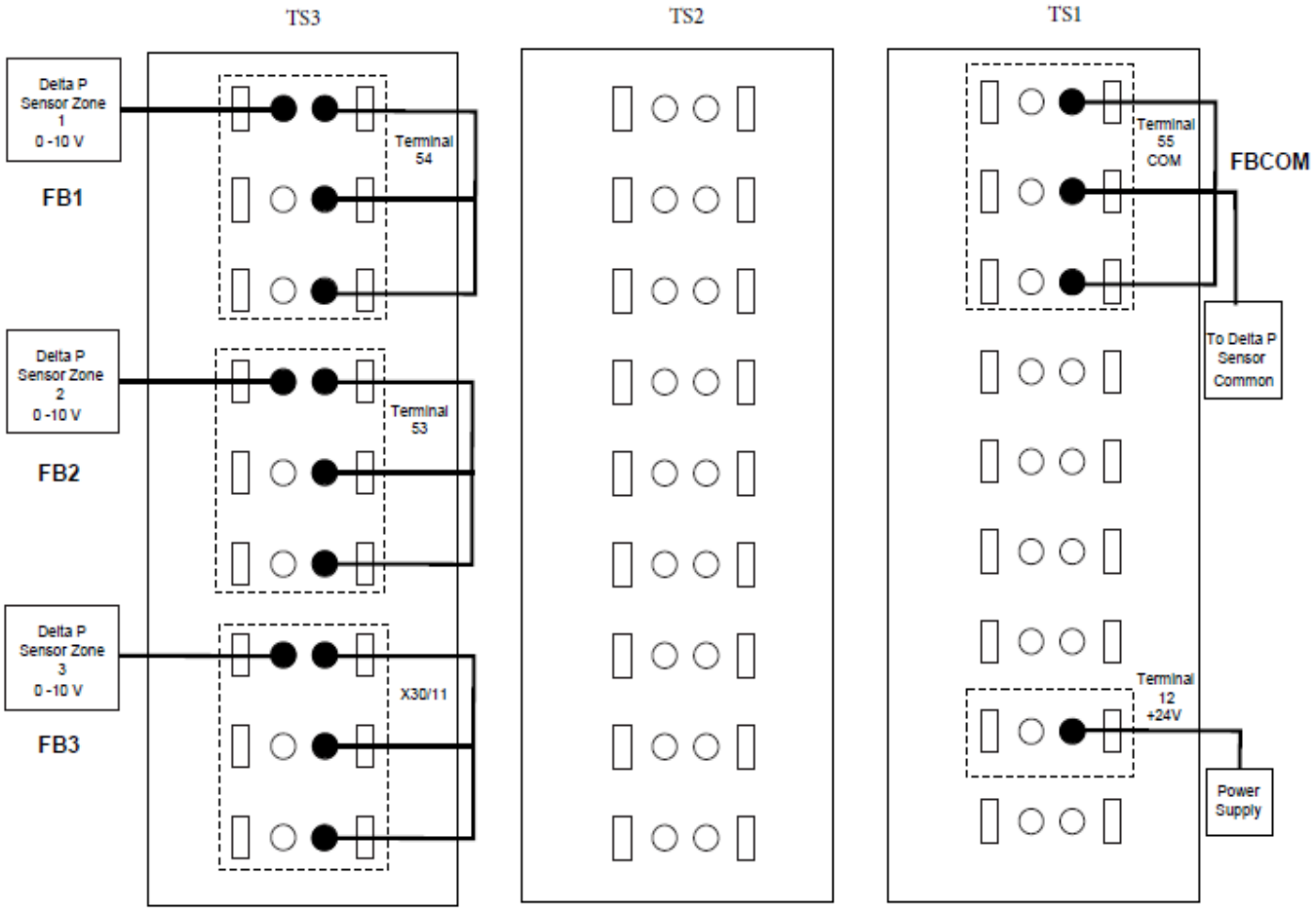


Table 6: Pressure Sensor Locations

FB1	Zone 1 Pressure Sensor
FB2	Zone 2 Pressure Sensor
FB3	Zone 3 Pressure Sensor
FBCOM	All Sensors Common

Table 7: Setting up parameters for a Three Drive Delta P Sensor

Parameter number	Description	to
6-14	Terminal 53 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0. For live 0 function set feedback to 1V or 10 PSI Note: Live 0 does not work ifminimum is set to 0.
6-15	Terminal 53 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–100 PSI transducer, set to 100.
6-17	Terminal 53 Live Zero	Enabled
6-24	Terminal 54 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0. For live 0 function set feedback to 1V or 10 PSI Note: Live 0 does not work ifminimum is set to 0.
6-25	Terminal 54 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–100 PSI transducer, set to 100.
6-27	Terminal 54 Live Zero	Enabled
6-34	Terminal X30/11 Low Ref./Feedb. Value	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0. For live 0 function set feedback to 1V or 10 PSI Note: Live 0 does not work if minimum is set to 0.
6-35	Terminal X30/11 High Ref./Feedb. Value	Maximum transducer input value. For example, for a 0–100 PSI transducer, set to 100.
6-37	Terminal 54 Live Zero	Enabled
20-00	Feedback 1 Source	Analog Input 54
20-03	Feedback 2 Source	Analog Input 53
20-06	Feedback 3 Source	Analog Input X30/11
20-12	Reference/Feedback	Set as appropriate for application. For example, set to PSI when using a pressure transducer. The default value for this setting is PSI.
20–13	Min Reference/Feed-back	Minimum transducer input value. For example, for a 0–100 PSI transducer, set to 0 PSI.
20–14	Max Reference/Feed-back	Maximum transducer input value. For example, for a 100 PSI transducer, set to 100 PSI.

3.5.2 Installation of Temperature Sensors

This configuration adds a temperature sensor for the Taco System Logic Program. On Terminal strip 3 (TS3), Feedback 1 (FB1) is for the supply temperature sensor and FB2 is for the return temperature sensor. The Delta T sensor will be powered by a 24V output from terminal 12.

Figure 3-4: Three Drive Terminal Wiring for Delta T Sensor

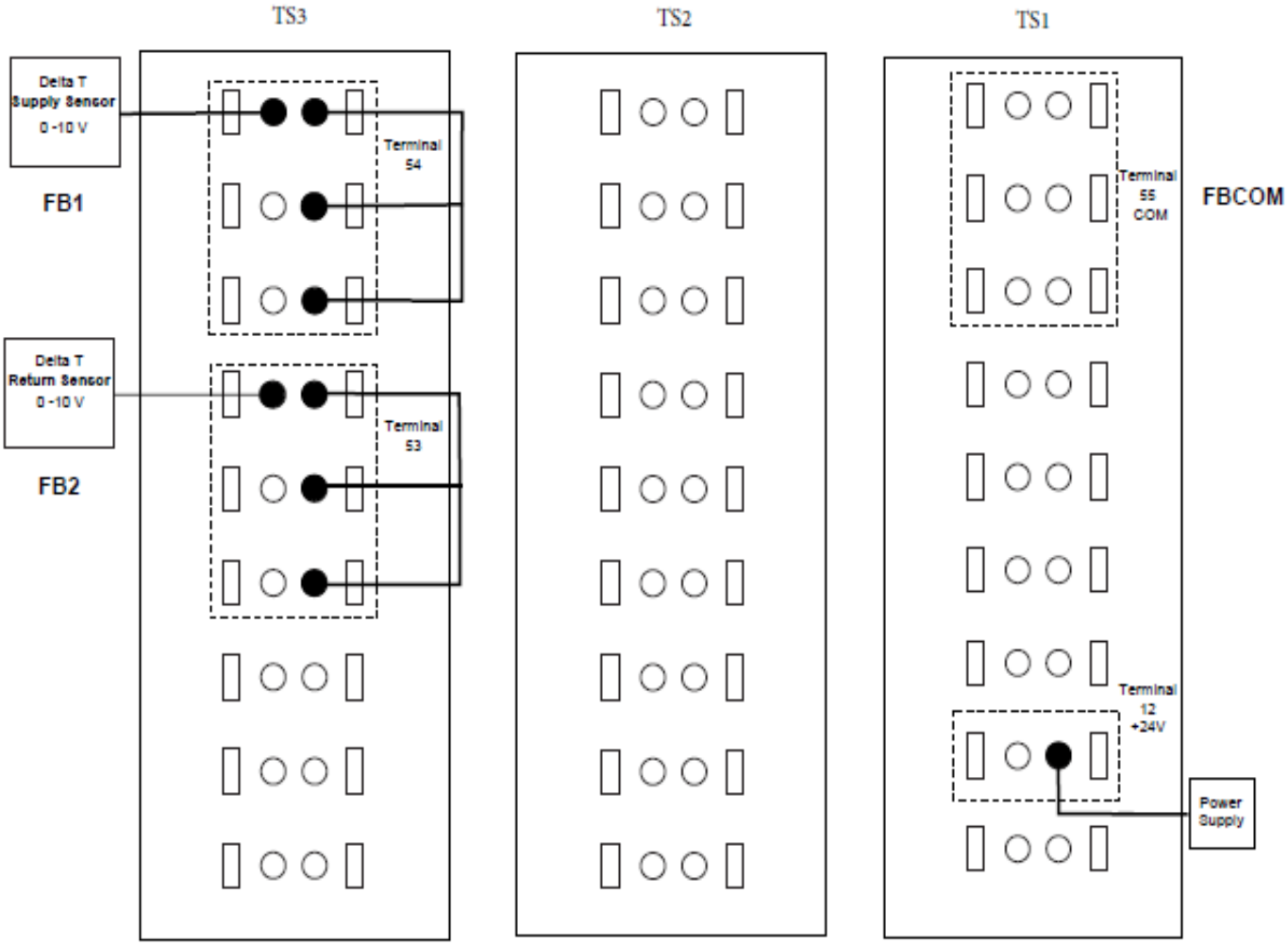


Table 8: Temperature Sensor Locations

FB1	Supply Temperature Sensor
FB2	Return Temperature Sensor

Table 9: Setting Parameters for a Delta T Sensor

Parameter number	Description	to
6-14	Terminal 53 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0. For live 0 function set feedback to 1V or 25°F Note: Live 0 does not work ifminimum is set to 0.
6-15	Terminal 53 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–250°F transducer, set to 250.
6-17	Terminal 53 Live Zero	Enabled
6-24	Terminal 54 Low Ref./ Feedb. Value	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0. For live 0 function set feedback to 1V or 25°F Note: Live 0 does not work if minimum is set to 0.
6-25	Terminal 54 High Ref./ Feedb. Value	Maximum transducer input value. For example, for a 0–250°F transducer, set to 250.
6-27	Terminal 54 Live Zero	Enabled
20-00	Feedback 1 Source	Analog Input 54
20-03	Feedback 1 Source	Analog Input 53
20-12	Reference/Feedback	Set as appropriate for application. For example, set to °F when using a Temperature transducer. The default value for this setting is °F.
20–13	MinReference/Feed-back	Minimum transducer input value. For example, for a 0–250°F transducer, set to 0 °F.
20–14	Max Reference/Feed-back	Maximum transducer input value. For example, for a 250 °F transducer, set to 250°F.

3.6 My Personal Menu for TSL

The **My Personal Menu** is arranged in order to take you step by step through the TSL start-up process.

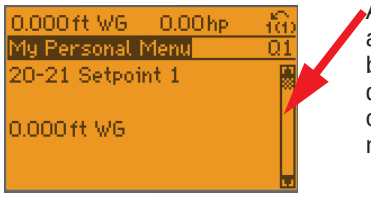
Before you begin, it is recommended to acquaint yourself with the **My Personal Menu**.

1. Press the [Quick Menus] button.

2. My Personal Menu appears at the top of the list.

3. Press the [OK] button.

4. Press the down arrow key to scroll down the **My Personal Menu** of parameters.



As you press the down arrow key, the scroll bar position moves down as you scroll from one parameter to the next.

5. After you arrive at the parameter you wish to adjust, press the [OK] button.

6. Use the arrow buttons to select/adjust the parameter.

7. Press [OK] when the parameter adjustment is complete.

8. Press the down arrow button  to scroll down to each consecutive parameter in the **My Personal Menu**.
9. The **My Personal Menu** structure is shown under ”Menus” starting on page 32.

3.7 Setting up 1-Drive Programs

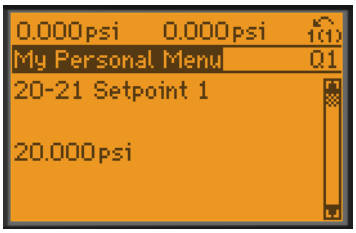
See section “3.4 My Personal Menu for TSL” on page 23 for information about how to access My Personal Menu.

Table 10: My Personal Menu for setting up 1-drive TSL programs

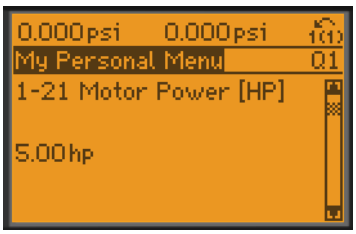
Parameter Number	Description
2021	Setpoint 1
121	Motor Power [HP]
122	Motor Voltage
123	Motor Frequency
124	Motor Current
125	Motor Nominal Speed
129	Automatic Motor Adaptation (AMA)
311	Jog Speed [Hz]
2243	Wake-up Speed [Hz]
412	Motor Speed Low Limit [Hz]
1320	SL Controller Timer
614	Terminal 53 Low Ref./Feedb. Value
615	Terminal 53 High Ref./Feedb. Value
624	Terminal 54 Low Ref./Feedb. Value
625	Terminal 54 High Ref./Feedb. Value
2014	Maximum Reference/Feedb.

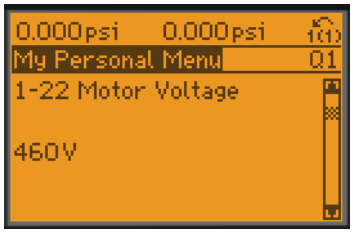
For this procedure, press the Quick Menu button. Navigate to My Personal Menu and press **OK**. Follow the instructions provided below.

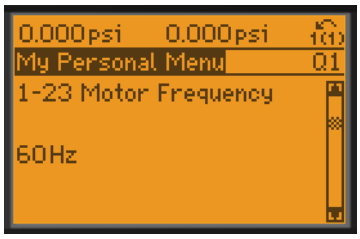
1. Using parameter **20-21 Setpoint 1**, set the system set point that you would like the pump to follow. If you are using this pump for a Delta P or Delta T job, this value is the desired Delta. For Booster applications, set the desired pressure set point.

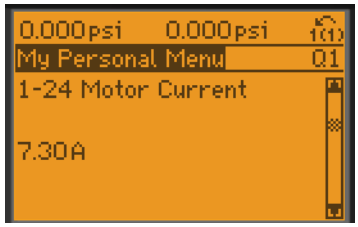


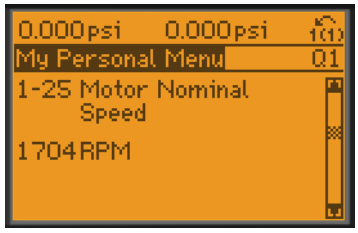
2. For the next 5 steps, you are checking and changing the parameters to make sure they match the information on the motor name plate.





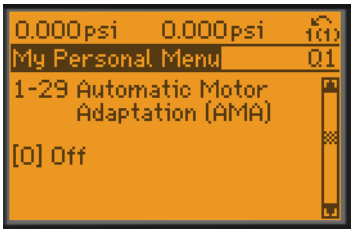






3. Next, use parameter **1-29 Automatic Motor Adaptation** run a full AMA to make sure that all the information is correct and the drive is functioning properly with the pump.

   NOTE: On some drives there might be a need to increase warning current limit in parameter **4-51 Warning Current High** to the current specified on motor name plate.



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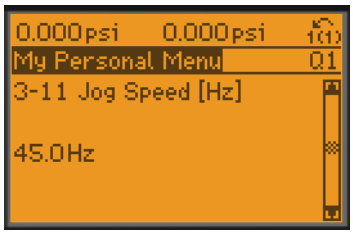
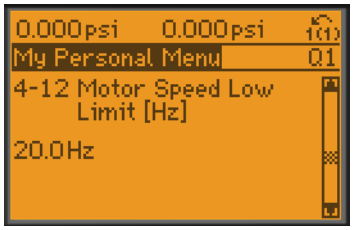
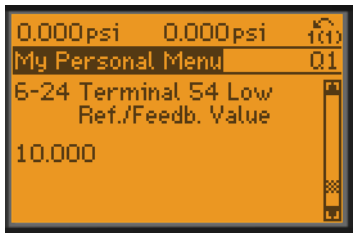
4. The Jog speed is the speed you would like the pump to run if fault tolerant control is activated. Use parameter **3-11 Jog Speed**.



5. For the booster system program, set the motor speed low limit to the minimum speed the pump needs to reach the design head. The drive from the factory is set at 20Hz.

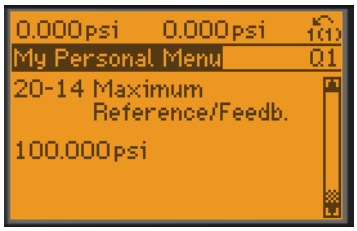


6. For delta P or using the booster program, you will see the below screens. If setting up the pump for delta T or a delta P with 2 differential pressure sensors refer to ”PART B” below.
   a. If the program was ordered without a Taco differential pressure sensor, the default value is 0-10V with a range of 0-100 PSI. The reason the below value reads 10PSI is because the low value for voltage is set to 1V. This setting is used so the drive can recognize 0V if the sensor should fail, allowing the drive to enable the sensor failure program. If you adjust the low voltage below 1V, the drive cannot recognize a sensor failure. If a sensor failure occurs under these conditions, the pump turns on and runs at 60Hz.



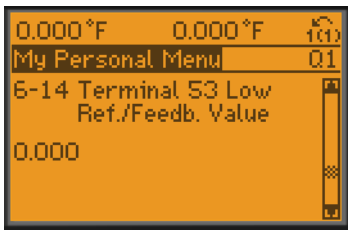
7. Next, set the high value of the sensor.

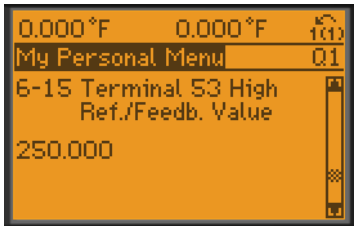
8. Next, using parameter 20-14 Maximum Reference/ Feedb., set the maximum Reference/Feedback value. This value is the same value you entered for terminal 54 high reference/feedback value.

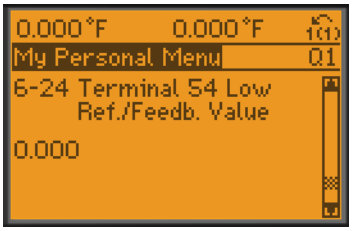


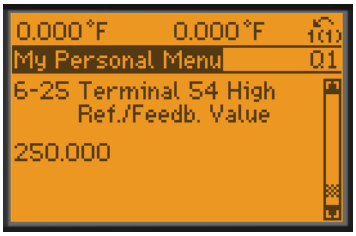
PART B

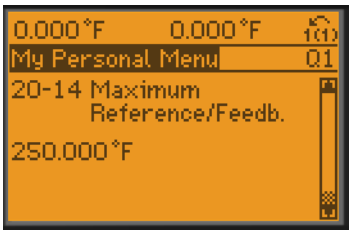
9. For Delta T applications using a non-supplied Taco sensor, you must adjust the low and high sensor range. The Taco temperature sensors are different from the pressure sensors because the temperature sensors deliver only a 2-10V signal with a range of 0-250.











3.8 Setting up 2- and 3-Drive Programs

See section “3.4 My Personal Menu for TSL” on page 23 for information about how to access My Personal Menu.

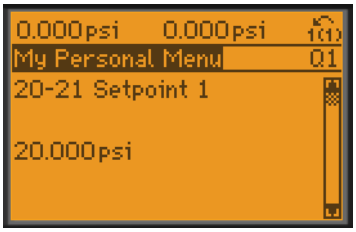
The table below shows the procedures used for drive start-up.

Table 11: My Personal Menu for setting up 2- and 3-drive TSL programs

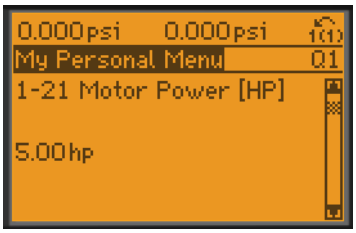
Parameter Number	Description
2021	Setpoint 1
121	Motor Power [HP]
122	Motor Voltage
123	Motor Frequency
124	Motor Current
125	Motor Nominal Speed
129	Automatic Motor Adaptation (AMA)
311	Jog Speed [Hz]
2243	Wake-up Speed [Hz]
412	Motor Speed Low Limit [Hz]
1320	SL Controller Timer
614	Terminal 53 Low Ref./Feedb. Value
615	Terminal 53 High Ref./Feedb. Value
624	Terminal 54 Low Ref./Feedb. Value
625	Terminal 54 High Ref./Feedb. Value
2014	Maximum Reference/Feedb.

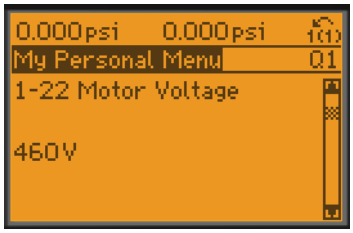
For this procedure, press the Quick Menu button. Navigate to My Personal Menu and press OK. Follow the instructions provided below.

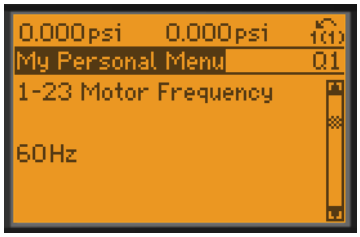
1. Using parameter **20-21 Setpoint 1**, set the system set point that you would like the pump to follow. If you are using this pump for a Delta P or Delta T job, this value is the desired Delta. For Booster applications, set the desired pressure set point.



2. For the next 5 steps, you are checking and changing the parameters to make sure they match the information on the motor name plate.







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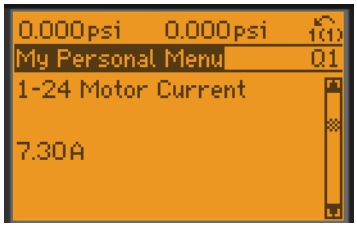
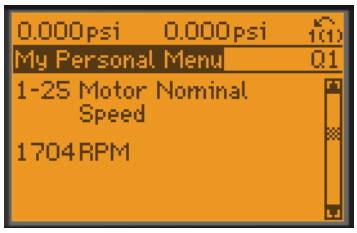
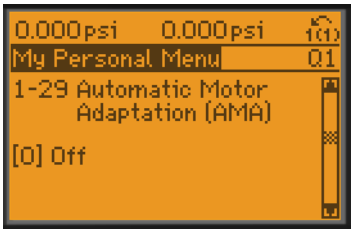




3. Next, use parameter **1-29 Automatic Motor Adaptation** run a full AMA to make sure that all the information is correct and the drive is functioning properly with the pump.

   NOTE: On some drives there might be a need to increase warning current limit in parameter **4-51 Warning Current High** to the current specified on motor name plate.



CAUTION: Complete the above steps for the rest of the pumps before continuing. The steps that follow require all the pumps to be running.

4. The Jog speed is the speed you would like the pump to run if fault tolerant control is activated. This setting helps prevent all the pumps turning on and over pressuring the system. Use parameter **3-11 Jog Speed**.

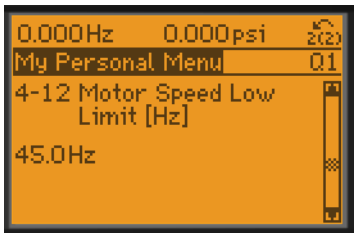
5. In this step, run the system up and down to make sure the staging is correct for the lag pump(s).

   This process needs to be done in setups 2 and 3 on the drive.

   a. Press **OK** and **Right** arrow button to switch the setup of Drive 1 to the next setup (Setup 2).

   b. Thefirst step is setting up when you would like the first lag pump to turn on. From the factory, it is set to turn on when the lead pump reaches 55 Hz. Some systems may require the lag pump to be turned on sooner while others may require it to wait for a higher frequency.

   c. Once the wake-up speed is set, you need to decide when the pump should turn off. Be careful with this setting: if you set the Hz too low, then the lag pump may never turn off. From the factory the pump is set at 45Hz.

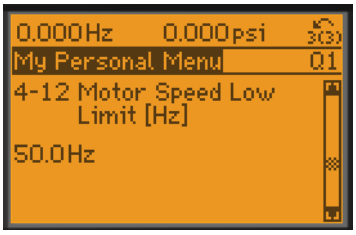


   NOTE: If only running a 2-drive system, you do not need to proceed to the next step.

6. If you are running our 3 drive program, you must repeat the same steps mentioned above for the 3rd drive.

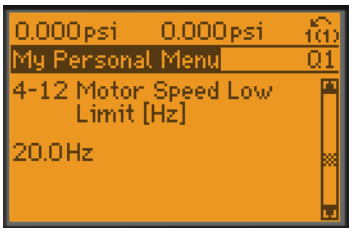
   a. Press **OK** and **Right** arrow button to switch the setup of Drive 1 to the next setup (Setup 3).

   b. Make sure to set the limits higher than the first lag pump so that the 3rd drive turns off before the 2nd drive and that it turns on after the 2nd drive has already turned on.



7. Once the drive is dialed in for setups 2 and 3, change the drive back to setup 1 to finish the process. Press **OK** and **Right** arrow at the same time to change the drive back to Setup 1.

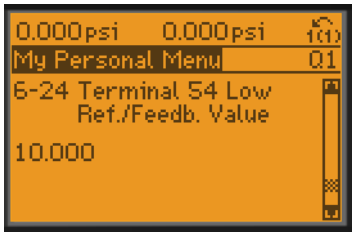
   NOTE: If using the booster program, set the motor speed low limit, so that the pump turns off when the system is at full pressure, to keep the pump from dead heading. From the factory the setting is 20Hz so it is important to modify this setting.



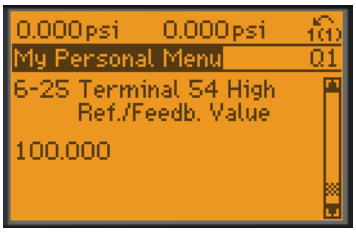
8. Setup required for the drive to operate properly is now completed. The remainder of the procedure steps are for changing the alternation timing and setting the sensor information if the drives were ordered without a Taco sensor. From the factory, alternation is setup for every 24 hours. (Technically, alternation is set for 23 hours, 59 minutes, 58 seconds because there is a 2-second delay built into the drive.) If you adjust the timing, make sure to account for the 2-second delay. This only needs to be changed on drive 1.

9. For delta P or using the booster program, you will see the below screens. If setting up the pump for delta T or a delta P with 2 differential pressure sensors refer to ”PART B” below.

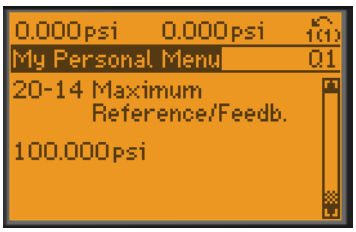
   a. If the program was ordered without a Taco differential pressure sensor, the default value is 0-10V with a range of 0-100 PSI. The reason the below value reads 10PSI is because the low value for voltage is set to 1V. This setting is used so the drive can recognize 0V if the sensor should fail, allowing the drive to enable the sensor failure program. If you adjust the low voltage below 1V, the drive cannot recognize a sensor failure. If a sensor failure occurs under these conditions, then all of the pumps turn on and run at 60Hz.



10. Next, set the high value of the sensor.

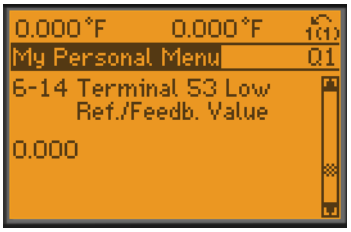


11. Next, using parameter 20-14 Maximum Reference/Feedb., set the maximum Reference/Feedback value. This value is the same value you entered for terminal 54 high reference/feedback value.



PART B

12. For Delta T applications using a non-supplied Taco sensor, you must adjust the low and high sensor range. The Taco temperature sensors are different from the pressure sensors because the temperature sensors deliver only a 2-10V signal with a range of 0-250.



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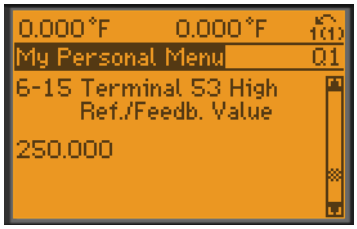
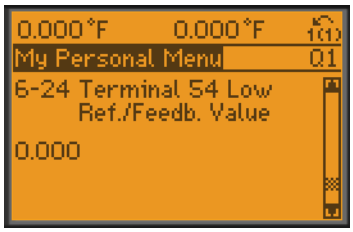
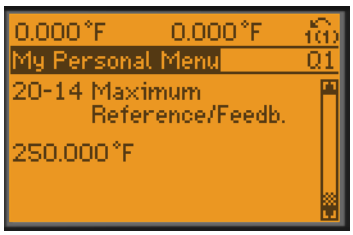






4 START-UP PROCEDURE

4.1 Check Points Before First Start

Verify that motor is correctly wired for voltage available.

Verify that the pump has been primed. The pump should never be run dry.

NOTE: Extra effort may be required to get the air out of the seal chamber.

WARNING: Make sure power supply to pump motor is locked out before touching motor shaft.

Verify that all rotating parts turn freely.

4.2 Check Motor Rotation

Before running the frequency converter, check the motor rotation. The motor will run briefly at 20Hz or the minimum frequency set in *4-12 Motor Speed Low Limit [Hz]*.

1. Check Motor rotation.
   a. Press [Hand on] button.

   b. Use the arrow keys to increase the Hz until you see the motor starting to spin.

   c. Once you can see the direction, press [Off] button.

NOTE: To change the direction of rotation, remove power to the frequency converter and wait for power to discharge. Reverse the connection of any two of the three motor cables on the motor or frequency converter side of the connection.

4.3 Start Pump

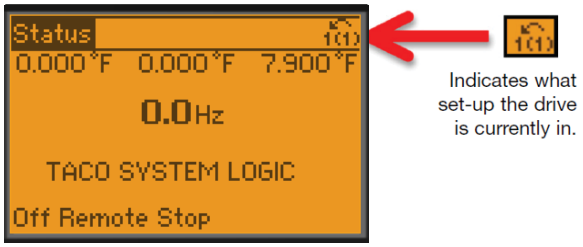
CAUTION: MOTOR START! Ensure that the motor, system, and any attached equipment is ready for start. It is the responsibility of the user to ensure safe operation under any condition. Failure to ensure that the motor, system, and any attached equipment is ready for start could result in personal injury or equipment damage.

The pump should be stopped if any of the following occur:

- No discharge.
- Insufficient discharge.
- Insufficient pressure.
- Loss of suction.
- Excessive power consumption.
- Vibration.

2. To navigate on the keypad, use the [OK] and [ARROW] buttons shown below.

3. Ensure the intended lead drive is in Set-up 1.



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4. Press the [Auto on] button.

5 MENUS

5.0.1 Quick Menu Structure - page 1

Q3-1 General Settings	0-24 Display Line 3 Large	1-00 Configuration Mode	**Q3-31 Single Zone Ext. Setpoint**	20-70 Closed-loop Type
Q3-10 Adv. Motor Settings	0-37 Display Text 1	20-12 Reference/Feedback Unit	1-00 Configuration Mode	20-71 PID Performance
1-90 Motor Thermal Protection	0-38 Display Text 2	20-13 Minimum Reference/ Feedb.	20-12 Reference/Feedback Unit	20-72 PID Output Change
1-93 Thermistor Source	0-39 Display Text 3	20-14 Maximum Reference/ Feedb.	20-13 Minimum Reference/ Feedb.	20-73 Minimum Feedback Level
1-29 Automatic Motor Adaptation (AMA)	**Q3-2 Open-loop Settings**	6-22 Terminal 54 Low Current	20-14 Maximum Reference/ Feedb.	20-74 Maximum Feedback Level
14-01 Switching Frequency	**Q3-20 Digital Reference**	6-24 Terminal 54 Low Ref./ Feedb. Value	6-10 Terminal 53 Low Voltage	20-79 PID Autotuning
4-53 Warning Speed High	3-02 Minimum Reference	6-25 Terminal 54 High Ref./ Feedb. Value	6-11 Terminal 53 High Voltage	**Q3-32 Multi Zone / Adv**
Q3-11 Analog Output	3-03 Maximum Reference	6-26 Terminal 54 Filter Time Constant	6-12 Terminal 53 Low Current	1-00 Configuration Mode
6-50 Terminal 42 Output	3-10 Preset Reference	6-27 Terminal 54 Live Zero	6-13 Terminal 53 High Current	3-15 Reference 1 Source
6-51 Terminal 42 Output Min Scale	5-13 Terminal 29 Digital Input	6-00 Live Zero Timeout Time	6-14 Terminal 53 Low Ref./Feedb. Value	3-16 Reference 2 Source
6-52 Terminal 42 Output Max Scale	5-14 Terminal 32 Digital Input	6-01 Live Zero Timeout Function	6-15 Terminal 53 High Ref./ Feedb. Value	20-00 Feedback 1 Source
Q3-12 Clock Settings	5-15 Terminal 33 Digital Input	20-21 Setpoint 1	6-22 Terminal 54 Low Current	20-01 Feedback 1 Conversion
0-70 Date and Time	**Q3-21 Analog Reference**	20-81 PID Normal/ Inverse Control	6-24 Terminal 54 Low Ref./Feedb. Value	20-02 Feedback 1 Source Unit
0-71 Date Format	3-02 Minimum Reference	20-82 PID Start Speed [RPM]	6-25 Terminal 54 High Ref./ Feedb. Value	20-03 Feedback 2 Source
0-72 Time Format	3-03 Maximum Reference	20-83 PID Start Speed [Hz]	6-26 Terminal 54 Filter Time Constant	20-04 Feedback 2 Conversion
0-74 DST/Summertime	6-10 Terminal 53 Low Voltage	20-93 PID Proportional Gain	6-27 Terminal 54 Live Zero	20-05 Feedback 2 Source Unit
0-76 DST/Summertime Start	6-11 Terminal 53 High Voltage	20-94 PID Integral Time	6-00 Live Zero Timeout Time	20-06 Feedback 3 Source
0-77 DST/Summertime End	6-12 Terminal 53 Low Current	20-70 Closed-loop Type	6-01 Live Zero Timeout Function	20-07 Feedback 3 Conversion
Q3-13 Display Settings	6-13 Terminal 53 High Current	20-71 PID Performance	20-81 PID Normal/ Inverse Control	20-08 Feedback 3 Source Unit
0-20 Display Line 1.1 Small	6-14 Terminal 53 Low Ref./ Feedb. Value	20-72 PID Output Change	20-82 PID Start Speed [RPM]	20-12 Reference/Feedback Unit

5.0.2 Quick Menu Structure - page 2

0-21 Display Line 1.2 Small	6-15 Terminal 53 High Ref./ Feedb. Value	20-73 Minimum Feedback Level	20-83 PID Start Speed [Hz]	20-13 Minimum Reference/ Feedb.
0-22 Display Line 1.3 Small	**Q3-3 Closed-loop Settings**	20-74 Maximum Feedback Level	20-93 PID Proportional Gain	20-14 Maximum Reference/ Feedb.
0-23 Display Line 2 Large	**Q3-30 Single Zone Int. Set-point**	20-79 PID Autotuning	20-94 PID Integral Time	6-10 Terminal 53 Low Voltage
6-11 Terminal 53 High Voltage	20-21 Setpoint 1	22-22 Low Speed Detection	22-21 Low Power Detection	22-87 Pressure at No-Flow Speed
6-12 Terminal 53 Low Current	20-22 Setpoint 2	22-23 No-Flow Function	22-22 Low Speed Detection	22-88 Pressure at Rated Speed
6-13 Terminal 53 High Current	20-81 PID Normal/ Inverse Control	22-24 No-Flow Delay	22-23 No-Flow Function	22-89 Flow at Design Point
6-14 Terminal 53 Low Ref./ Feedb. Value	20-82 PID Start Speed [RPM]	22-40 Minimum Run Time	22-24 No-Flow Delay	22-90 Flow at Rated Speed
6-15 Terminal 53 High Ref./ Feedb. Value	20-83 PID Start Speed [Hz]	22-41 Minimum Sleep Time	22-40 Minimum Run Time	1-03 Torque Characteristics
6-16 Terminal 53 Filter Time Constant	20-93 PID Proportional Gain	22-42 Wake-up Speed [RPM]	22-41 Minimum Sleep Time	1-73 Flying Start
6-17 Terminal 53 Live Zero	20-94 PID Integral Time	22-43 Wake-up Speed [Hz]	22-42 Wake-up Speed [RPM]	**Q3-42 Compressor Functions**
6-20 Terminal 54 Low Voltage	20-70 Closed-loop Type	22-44 Wake-up Ref./FB Difference	22-43 Wake-up Speed [Hz]	1-03 Torque Characteristics
6-21 Terminal 54 High Voltage	20-71 PID Performance	22-45 Setpoint Boost	22-44 Wake-up Ref./FB Difference	1-71 Start Delay
6-22 Terminal 54 Low Current	20-72 PID Output Change	22-46 Maximum Boost Time	22-45 Setpoint Boost	22-75 Short Cycle Protection
6-23 Terminal 54 High Current	20-73 Minimum Feedback Level	2-10 Brake Function	22-46 Maximum Boost Time	22-76 Interval between Starts
6-24 Terminal 54 Low Ref./ Feedb. Value	20-74 Maximum Feedback Level	2-16 AC Brake Max. Current	22-26 Dry Pump Function	22-77 Minimum Run Time
6-25 Terminal 54 High Ref./ Feedb. Value	20-79 PID Autotuning	2-17 Over-voltage Control	22-27 Dry Pump Delay	5-01 Terminal 27 Mode
6-26 Terminal 54 Filter Time Constant	**Q3-4 Application Settings**	1-73 Flying Start	22-80 Flow Compensation	5-02 Terminal 29 Mode
6-27 Terminal 54 Live Zero	**Q3-40 Fan Functions**	1-71 Start Delay	22-81 Square-linear Curve Approximation	5-12 Terminal 27 Digital Input
6-00 Live Zero Timeout Time	22-60 Broken Belt Function	1-80 Function at Stop	22-82 Work Point Calculation	5-13 Terminal 29 Digital Input
6-01 Live Zero Timeout Function	22-61 Broken Belt Torque	2-00 DC Hold/Preheat Current	22-83 Speed at No-Flow [RPM]	5-40 Function Relay
4-56 Warning Feedback Low	22-62 Broken Belt Delay	4-10 Motor Speed Direction	22-84 Speed at No-Flow [Hz]	1-73 Flying Start
4-57 Warning Feedback High	4-64 Semi-Auto Bypass Set-up	**Q3-41 Pump Functions**	22-85 Speed at Design Point [RPM]	1-86 Trip Speed Low [RPM]
20-20 Feedback Function	1-03 Torque Characteristics	22-20 Low Power Auto Set-up	22-86 Speed at Design Point [Hz]	1-87 Trip Speed Low [Hz]

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***0*-** Operation / Display**	0-37 Display Text 1	0-77 DST/Summertime End	1-36 Iron Loss Resistance (Rfe)	1-82 Min Speed for Function at Stop [Hz]
0-0* Basic Settings	0-38 Display Text 2	0-79 Clock Fault	1-39 Motor Poles	1-86 Trip Speed Low [RPM]
0-01 Language	0-39 Display Text 3	0-81 Working Days	**1-5* Load-Indep. Setting**	1-87 Trip Speed Low [Hz]
0-02 Motor Speed Unit	**0-4* LCP Keypad**	0-82 Additional Working Days	1-50 Motor Magnetization at Zero Speed	**1-9* Motor Temperature**
0-03 Regional Settings	0-40 [Hand on] Key on LCP	0-83 Additional Non-Working Days	1-51 Min Speed Normal Magnetizing [RPM]	1-90 Motor Thermal Protection
0-04 Operating State at Power-up	0-41 [Off] Key on LCP	0-89 Date and Time Readout	1-52 Min Speed Normal Magnetizing [Hz]	1-91 Motor External Fan
0-05 Local Mode Unit	0-42 [Auto on] Key on LCP	**1-** Load and Motor**	1-58 Flystart Test Pulses Current	1-93 Thermistor Source
0-1* Set-up Operations	0-43 [Reset] Key on LCP	**1-0* General Settings**	1-59 Flystart Test Pulses Frequency	**2-** Brakes**
0-10 Active Set-up	0-44 [Off/Reset] Key on LCP	1-00 Configuration Mode	**1-6* Load-Depend. Settg.**	**2-0* DC Brake**
0-11 Programming Set-up	0-45 [Drive Bypass] Key on LCP	1-03 Torque Characteristics	1-60 Low Speed Load Compensation	2-00 DC Hold/Preheat Current
0-12 This Set-up Linked to	**0-5* Copy/Save**	1-06 Clockwise Direction	1-61 High Speed Load Compensation	2-01 DC Brake Current
0-13 Readout: Linked Set-ups	0-50 LCP Copy	**1-2* Motor Data**	1-62 Slip Compensation	2-02 DC Braking Time
0-14 Readout: Prog. Set-ups / Channel	0-51 Set-up Copy	1-20 Motor Power [kW]	1-63 Slip Compensation Time Constant	2-03 DC Brake Cut-in Speed [RPM]
0-2* LCP Display	**0-6* Password**	1-21 Motor Power [HP]	1-64 Resonance Dampening	2-04 DC Brake Cut In Speed [Hz]
0-20 Display Line 1.1 Small	0-60 Main Menu Password	1-22 Motor Voltage	1-65 Resonance Dampening Time Constant	**2-1* Brake Energy Funct.**
0-21 Display Line 1.2 Small	0-61 Access to Main Menu w/ o Password	1-23 Motor Frequency	**1-7* Start Adjustments**	2-10 Brake Function
0-22 Display Line 1.3 Small	0-65 Personal Menu Password	1-24 Motor Current	1-71 Start Delay	2-11 Brake Resistor (ohm)
0-23 Display Line 2 Large	0-66 Access to Personal Menu w/o Password	1-25 Motor Nominal Speed	1-73 Flying Start	2-12 Brake Power Limit (kW)
0-24 Display Line 3 Large	**0-7* Clock Settings**	1-28 Motor Rotation Check	1-77 Compressor Start Max Speed [RPM]	2-13 Brake Power Monitoring
0-25 My Personal Menu	0-70 Date and Time	1-29 Automatic Motor Adaptation (AMA)	1-78 Compressor Start Max Speed [Hz]	2-15 Brake Check
0-3* LCP Cust. Readout	0-71 Date Format	**1-3* Addl. Motor Data**	1-79 Compressor Start Max Time to Trip	2-16 AC Brake Max. Current
0-30 Custom Readout Unit	0-72 Time Format	1-30 Stator Resistance (Rs)	**1-8* Stop Adjustments**	2-17 Over-voltage Control
0-31 Custom Readout Min Value	0-74 DST/Summertime	1-31 Rotor Resistance (Rr)	1-80 Function at Stop	**3-** Reference / Ramps**

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0-32 Custom Readout Max Value	0-76 DST/Summertime Start	1-35 Main Reactance (Xh)	1-81 Min Speed for Function at Stop [RPM]	**3-0* Reference Limits**
3-02 Minimum Reference	3-92 Power Restore	**4-6* Speed Bypass**	5-33 Term X30/7 Digi Out (MCB 101)	5-93 Pulse Out #27 Bus Control
3-03 Maximum Reference	3-93 Maximum Limit	4-60 Bypass Speed From [RPM]	**5-4* Relays**	5-94 Pulse Out #27 Timeout Preset
3-04 Reference Function	3-94 Minimum Limit	4-61 Bypass Speed From [Hz]	5-40 Function Relay	5-95 Pulse Out #29 Bus Control
3-1* References	3-95 Ramp Delay	4-62 Bypass Speed to [RPM]	5-41 On Delay, Relay	5-96 Pulse Out #29 Timeout Preset
3-10 Preset Reference	**4-** Limits / Warnings**	4-63 Bypass Speed To [Hz]	5-42 Off Delay, Relay	5-97 Pulse Out #X30/6 Bus Control
3-11 Jog Speed [Hz]	**4-1* Motor Limits**	4-64 Semi-Auto Bypass Set-up	**5-5* Pulse Input**	5-98 Pulse Out #X30/6 Timeout Preset
3-13 Reference Site	4-10 Motor Speed Direction	**5-** Digital In/Out**	5-50 Term. 29 Low Frequency	**6-** Analog In/Out**
3-14 Preset Relative Reference	4-11 Motor Speed Low Limit [RPM]	**5-0* Digital I/O mode**	5-51 Term. 29 High Frequency	**6-0* Analog I/O Mode**
3-15 Reference 1 Source	4-12 Motor Speed Low Limit [Hz]	5-00 Digital I/O Mode	5-52 Term. 29 Low Ref./Feedb. Value	6-00 Live Zero Timeout Time
3-16 Reference 2 Source	4-13 Motor Speed High Limit [RPM]	5-01 Terminal 27 Mode	5-53 Term. 29 High Ref./Feedb. Value	6-01 Live Zero Timeout Function
3-17 Reference 3 Source	4-14 Motor Speed High Limit [Hz]	5-02 Terminal 29 Mode	5-54 Pulse Filter Time Constant #29	6-02 Fire Mode Live Zero Timeout Function
3-19 Jog Speed [RPM]	4-16 Torque Limit Motor Mode	**5-1* Digital Inputs**	5-55 Term. 33 Low Frequency	**6-1* Analog Input 53**
3-4* Ramp 1	4-17 Torque Limit Generator Mode	5-10 Terminal 18 Digital Input	5-56 Term. 33 High Frequency	6-10 Terminal 53 Low Voltage
3-41 Ramp 1 Ramp-up Time	4-18 Current Limit	5-11 Terminal 19 Digital Input	5-57 Term. 33 Low Ref./Feedb. Value	6-11 Terminal 53 High Voltage
3-42 Ramp 1 Ramp-down Time	4-19 Max Output Frequency	5-12 Terminal 27 Digital Input	5-58 Term. 33 High Ref./Feedb. Value	6-12 Terminal 53 Low Current
3-5* Ramp 2	**4-5* Adj. Warnings**	5-13 Terminal 29 Digital Input	5-59 Pulse Filter Time Constant #33	6-13 Terminal 53 High Current
3-51 Ramp 2 Ramp-up Time	4-50 Warning Current Low	5-14 Terminal 32 Digital Input	**5-6* Pulse Output**	6-14 Terminal 53 Low Ref./Feedb. Value
3-52 Ramp 2 Ramp-down Time	4-51 Warning Current High	5-15 Terminal 33 Digital Input	5-60 Terminal 27 Pulse Output Variable	6-15 Terminal 53 High Ref./Feedb. Value
3-8* Other Ramps	4-52 Warning Speed Low	5-16 Terminal X30/2 Digital Input	5-62 Pulse Output Max Freq #27	6-16 Terminal 53 Filter Time Constant
3-80 Jog Ramp Time	4-53 Warning Speed High	5-17 Terminal X30/3 Digital Input	5-63 Terminal 29 Pulse Output Variable	6-17 Terminal 53 Live Zero

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3-81 Quick Stop Ramp Time	4-54 Warning Reference Low	5-18 Terminal X30/4 Digital Input	5-65 Pulse Output Max Freq #29	**6-2* Analog Input 54**
3-82 Starting Ramp Up Time	4-55 Warning Reference High	**5-3* Digital Outputs**	5-66 Terminal X30/6 Pulse Output Variable	6-20 Terminal 54 Low Voltage
3-9* Digital Pot. meter	4-56 Warning Feedback Low	5-30 Terminal 27 Digital Output	5-68 Pulse Output Max Freq #X30/6	6-21 Terminal 54 High Voltage
3-90 Step Size	4-57 Warning Feedback High	5-31 Terminal 29 Digital Output	**5-9* Bus Controlled**	6-22 Terminal 54 Low Current
3-91 Ramp Time	4-58 Missing Motor Phase Function	5-32 Term X30/6 Digi Out (MCB 101)	5-90 Digital & Relay Bus Control	6-23 Terminal 54 High Current
6-24 Terminal 54 Low Ref./ Feedb. Value	6-64 Terminal X30/8 Output Timeout Preset	8-52 DC Brake Select	9-16 PCD Read Configuration	**10-** CAN Fieldbus**
6-25 Terminal 54 High Ref./ Feedb. Value	**8-** Comm. and Options**	8-53 Start Select	9-18 Node Address	**10-0* Common Settings**
6-26 Terminal 54 Filter Time Constant	**8-0* General Settings**	8-54 Reversing Select	9-22 Telegram Selection	10-00 CAN Protocol
6-27 Terminal 54 Live Zero	8-01 Control Site	8-55 Set-up Select	9-23 Parameters for Signals	10-01 Baud Rate Select
6-3* Analog Input X30/11	8-02 Control Source	8-56 Preset Reference Select	9-27 Parameter Edit	10-02 MAC ID
6-30 Terminal X30/11 Low Voltage	8-03 Control Timeout Time	**8-7* BACnet**	9-28 Process Control	10-05 Readout Transmit Error Counter
6-31 Terminal X30/11 High Voltage	8-04 Control Timeout Function	8-70 BACnet Device Instance	9-44 Fault Message Counter	10-06 Readout Receive Error Counter
6-34 Term. X30/11 Low Ref./ Feedb. Value	8-05 End-of-Timeout Function	8-72 MS/TP Max Masters	9-45 Fault Code	10-07 Readout Bus Off Counter
6-35 Term. X30/11 High Ref./ Feedb. Value	8-06 Reset Control Timeout	8-73 MS/TP Max Info Frames	9-47 Fault Number	**10-1* DeviceNet**
6-36 Term. X30/11 Filter Time Constant	8-07 Diagnosis Trigger	8-74 "I-Am" Service	9-52 Fault Situation Counter	10-10 Process Data Type Selection
6-37 Term. X30/11 Live Zero	8-08 Readout Filtering	8-75 Initialization Password	9-53 Profibus Warning Word	10-11 Process Data Con!g Write
6-4* Analog Input X30/12	**8-1* Control Settings**	**8-8* FC Port Diagnostics**	9-63 Actual Baud Rate	10-12 Process Data Con!g Read
6-40 Terminal X30/12 Low Voltage	8-10 Control Profile	8-80 Bus Message Count	9-64 Device Identification	10-13 Warning Parameter
6-41 Terminal X30/12 High Voltage	8-13 Configurable Status Word STW	8-81 Bus Error Count	9-65 Profile Number	10-14 Net Reference
6-44 Term. X30/12 Low Ref./ Feedb. Value	**8-3* FC Port Settings**	8-82 Slave Messages Rcvd	9-67 Control Word 1	10-15 Net Control
6-45 Term. X30/12 High Ref./ Feedb. Value	8-30 Protocol	8-83 Slave Error Count	9-68 Status Word 1	**10-2* COS Filters**
6-46 Term. X30/12 Filter Time Constant	8-31 Address	8-84 Slave Messages Sent	9-70 Programming Set-up	10-20 COS Filter 1

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6-47 Term. X30/12 Live Zero	8-32 Baud Rate	8-85 Slave Timeout Errors	9-71 Profibus Save Data Values	10-21 COS Filter 2
6-5* Analog Output	42 8-33 Parity / Stop Bits	8-89 Diagnostics Count	9-72 ProfibusDriveReset	10-22 COS Filter 3
6-50 Terminal 42 Output	8-34 Estimated cycle time	**8-9* Bus Jog / Feedback**	9-80 Defined Parameters (1)	10-23 COS Filter 4
6-51 Terminal 42 Output Min Scale	8-35 Minimum Response Delay	8-90 Bus Jog 1 Speed	9-81 Defined Parameters (2)	**10-3* Parameter Access**
6-52 Terminal 42 Output Max Scale	8-36 Maximum Response Delay	8-91 Bus Jog 2 Speed	9-82 Defined Parameters (3)	10-30 Array Index
6-53 Terminal 42 Output Bus Control	8-37 Maximum Inter-Char Delay	8-94 Bus Feedback 1	9-83 Defined Parameters (4)	10-31 Store Data Values
6-54 Terminal 42 Output Time-out Preset	**8-4* FC MC protocol set**	8-95 Bus Feedback 2	9-84 Defined Parameters (5)	10-32 Devicenet Revision
6-6* Analog Output X30/8	8-40 Telegram selection	8-96 Bus Feedback 3	9-90 Changed Parameters (1)	10-33 Store Always
6-60 Terminal X30/8 Output	8-42 PCD write configuration	**9-** Profibus**	9-91 Changed Parameters (2)	10-34 DeviceNet Product Code
6-61 Terminal X30/8 Min. Scale	8-43 PCD read configuration	9-00 Setpoint	9-92 Changed Parameters (3)	10-39 Devicenet F Parameters
6-62 Terminal X30/8 Max. Scale	**8-5* Digital/Bus**	9-07 Actual Value	9-93 Changed Parameters (4)	**11-** LonWorks**
6-63 Terminal X30/8 Output Bus Control	8-50 Coasting Select	9-15 PCD Write Configuration	9-94 Changed parameters (5)	**11-0* LonWorks ID**
11-00 Neuron ID	**14-** Special Functions**	14-50 RFI Filter	15-23 Historic Log: Date and Time	15-72 Option in Slot B
11-1* LON Functions	**14-0* Inverter Switching**	14-51 DC Link Compensation	**15-3* Alarm Log**	15-73 Slot B Option SW Version
11-10 Drive Profile	14-00 Switching Pattern	14-52 Fan Control	15-30 Alarm Log: Error Code	15-74 Option in Slot C0
11-15 LON Warning Word	14-01 Switching Frequency	14-53 Fan Monitor	15-31 Alarm Log: Value	15-75 Slot C0 Option SW Version
11-17 XIF Revision	14-03 Overmodulation	**14-6* Auto Derate**	15-32 Alarm Log: Time	15-76 Option in Slot C1
11-18 LonWorks Revision	14-04 PWM Random	14-60 Function at Overtemperature	15-33 Alarm Log: Date and Time	15-77 Slot C1 Option SW Version
11-2* LON Param. Access	**14-1* Mains On/Off**	14-61 Function at Inverter Overload	**15-4* Drive Identification**	**15-9* Parameter Info**
11-21 Store Data Values	14-10 Mains Failure	14-62 Inv. Overload Derate Current	15-40 FC Type	15-92 Defined Parameters
13- Smart Logic**	14-11 Mains Voltage at Mains Fault	**15-** Drive Information**	15-41 Power Section	15-93 Modi!ed Parameters
13-0* SLC Settings	14-12 Function at Mains Imbalance	**15-0* Operating Data**	15-42 Voltage	15-98 Drive Identification
13-00 SL Controller Mode	**14-2* Reset Functions**	15-00 Operating Hours	15-43 Software Version	15-99 Parameter Metadata
13-01 Start Event	14-20 Reset Mode	15-01 Running Hours	15-44 Ordered Typecode String	**16-** Data Readouts**
13-02 Stop Event	14-21 Automatic Restart Time	15-02 kWh Counter	15-45 Actual Typecode String	**16-0* General Status**
13-03 Reset SLC	14-22 Operation Mode	15-03 Power-ups	15-46 Adjustable Frequency Drive Ordering No	16-00 Control Word

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13-1* Comparators	14-23 Typecode Setting	15-04 Overtemps	15-47 Power Card Ordering No	16-01 Reference [Unit]
13-10 Comparator Operand	14-25 Trip Delay at Torque Limit	15-05 Overvolts	15-48 LCP Id No	16-02 Reference [%]
13-11 Comparator Operator	14-26 Trip Delay at Inverter Fault	15-06 Reset kWh Counter	15-49 SW ID Control Card	16-03 Status Word
13-12 Comparator Value	14-28 Production Settings	15-07 Reset Running Hours Counter	15-50 SW ID Power Card	16-05 Main Actual Value [%]
13-2* Timers	14-29 Service Code	15-08 Number of Starts	15-51 Adj. Frequency Drive Serial Number	16-09 Custom Readout
13-20 SL Controller Timer	**14-3* Current Limit Ctrl.**	**15-1* Data Log Settings**	15-53 Power Card Serial Number	**16-1* Motor Status**
13-4* Logic Rules	14-30 Current Lim Ctrl, Proportional Gain	15-10 Logging Source	15-55 Vendor URL	16-10 Power [kW]
13-40 Logic Rule Boolean 1	14-31 Current Lim Ctrl, Integration Time	15-11 Logging Interval	15-56 Vendor Name	16-11 Power [hp]
13-41 Logic Rule Operator 1	14-32 Current Lim Ctrl, Filter Time	15-12 Trigger Event	**15-6* Option Ident**	16-12 Motor Voltage
13-42 Logic Rule Boolean 2	**14-4* Energy Optimizing**	15-13 Logging Mode	15-60 Option Mounted	16-13 Frequency
13-43 Logic Rule Operator 2	14-40 VT Level	15-14 Samples Before Trigger	15-61 Option SW Version	16-14 Motor Current
13-44 Logic Rule Boolean 3	14-41 AEO Minimum Magnetization	**15-2* Historic Log**	15-62 Option Ordering No	16-15 Frequency [%]
13-5* States	14-42 Minimum AEO Frequency	15-20 Historic Log: Event	15-63 Option Serial No	16-16 Torque [Nm]
13-51 SL Controller Event	14-43 Motor Cosphi	15-21 Historic Log: Value	15-70 Option in Slot A	16-17 Speed [RPM]
13-52 SL Controller Action	**14-5* Environment**	15-22 Historic Log: Time	15-71 Slot A Option SW Version	16-18 Motor Thermal
16-22 Torque [%]	16-66 Digital Output [bin]	**18-1* Fire Mode Log**	20-14 Maximum Reference/ Feedb.	20-84 On Reference Bandwidth
16-26 Power Filtered [kW]	16-67 Pulse Input #29 [Hz]	18-10 Fire Mode Log: Event	**20-2* Feedback/Setpoint**	**20-9* PID Controller**
16-27 Power Filtered [hp]	16-68 Pulse Input #33 [Hz]	18-11 Fire Mode Log: Time	20-20 Feedback Function	20-91 PID Anti Windup
16-3* Drive Status	16-69 Pulse Output #27 [Hz]	18-12 Fire Mode Log: Date and Time	20-21 Setpoint 1	20-93 PID Proportional Gain
16-30 DC Link Voltage	16-70 Pulse Output #29 [Hz]	**18-3* Inputs & Outputs**	20-22 Setpoint 2	20-94 PID Integral Time
16-32 Brake Energy /s	16-71 Relay Output [bin]	18-30 Analog Input X42/1	20-23 Setpoint 3	20-95 PID Differentiation Time
16-33 Brake Energy /2 min	16-72 Counter A	18-31 Analog Input X42/3	**20-3* Feedb. Adv. Conv.**	20-96 PID Diff. Gain Limit
16-34 Heatsink Temp.	16-73 Counter B	18-32 Analog Input X42/5	20-30 Refrigerant	**21-** Ext. Closed-loop**
16-36 Inv. Nom. Current	16-75 Analog In X30/11	18-33 Analog Out X42/7 [V]	20-31 User Defined Refrigerant A1	**21-0* Ext. CL Autotuning**
16-37 Inv. Max. Current	16-76 Analog In X30/12	18-34 Analog Out X42/9 [V]	20-32 User-defined Refrigerant A2	21-00 Closed-loop Type

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16-38 SL Controller State	16-77 Analog Out X30/8 [mA]	18-35 Analog Out X42/11 [V]	20-33 User-defined Refrigerant A3	21-01 PID Performance
16-39 Control Card Temp.	**16-8* Fieldbus & FC Port**	18-36 Analog Input X48/2 [mA]	20-34 Duct 1 Area [m2]	21-02 PID Output Change
16-40 Logging Buffer Full	16-80 Fieldbus CTW 1	18-37 Temp. Input X48/4	20-35 Duct 1 Area [in2]	21-03 Minimum Feedback Level
16-43 Timed Actions Status	16-82 Fieldbus REF 1	18-38 Temp. Input X48/7	20-36 Duct 2 Area [m2]	21-04 Maximum Feedback Level
16-49 Current Fault Source	16-84 Comm. Option STW	18-39 Temp. Input X48/10	20-37 Duct 2 Area [in2]	21-09 PID Autotuning
16-5* Ref. & Feedb.	16-85 FC Port CTW 1	18-5* Ref. & Feedb.	20-38 Air Density Factor [%]	**21-1* Ext. CL 1 Ref./Fb.**
16-50 External Reference	16-86 FC Port REF 1	18-50 Sensorless Readout [unit]	**20-6* Sensorless**	21-10 Ext. 1 Ref./Feedback Unit
16-52 Feedback [Unit]	**16-9* Diagnosis Readouts**	**20-** Drive Closed-loop**	20-60 Sensorless Unit	21-11 Ext. 1 Minimum Reference
16-53 Digi Pot Reference	16-90 Alarm Word	**20-0* Feedback**	20-69 Sensorless Information	21-12 Ext. 1 Maximum Reference
16-54 Feedback 1 [Unit] 2	16-91 Alarm Word	20-00 Feedback 1 Source	**20-7* PID Autotuning**	21-13 Ext. 1 Reference Source
16-55 Feedback 2 [Unit]	16-92 Warning Word	20-01 Feedback 1 Conversion	20-70 Closed-loop Type	21-14 Ext. 1 Feedback Source
16-56 Feedback 3 [Unit]	16-93 Warning Word 2	20-02 Feedback 1 Source Unit	20-71 PID Performance	21-15 Ext. 1 Setpoint
16-58 PID Output [%]	16-94 Ext. Status Word	20-03 Feedback 2 Source	20-72 PID Output Change	21-17 Ext. 1 Reference [Unit]
16-6* Inputs & Outputs	16-96 Maintenance Word	20-04 Feedback 2 Conversion	20-73 Minimum Feedback Level	21-18 Ext. 1 Feedback [Unit]
16-60 Digital Input	**18-** Info & Readouts**	20-05 Feedback 2 Source Unit	20-74 Maximum Feedback Level	21-19 Ext. 1 Output [%]
16-61 Terminal 53 Switch Setting	**18-0* Maintenance Log**	20-06 Feedback 3 Source	20-79 PID Autotuning	**21-2* Ext. CL 1 PID**
16-62 Analog Input 53	18-00 Maintenance Log: Item	20-07 Feedback 3 Conversion	**20-8* PID Basic Settings**	21-20 Ext. 1 Normal/Inverse Control
16-63 Terminal 54 Switch Setting	18-01 Maintenance Log: Action	20-08 Feedback 3 Source Unit	20-81 PID Normal/ Inverse Control	21-21 Ext. 1 Proportional Gain
16-64 Analog Input 54	18-02 Maintenance Log: Time	20-12 Reference/Feedback Unit	20-82 PID Start Speed [RPM]	21-22 Ext. 1 Integral Time
16-65 Analog Output 42 [mA]	18-03 Maintenance Log: Date and Time	20-13 Minimum Reference/ Feedb.	20-83 PID Start Speed [Hz]	21-23 Ext. 1 Differentation Time
21-24 Ext. 1 Dif. Gain Limit	21-60 Ext. 3 Normal/Inverse Control	**22-4* Sleep Mode**	22-86 Speed at Design Point [Hz]	23-60 Trend Variable
21-3* Ext. CL 2 Ref./Fb.	21-61 Ext. 3 Proportional Gain	22-40 Minimum Run Time	22-87 Pressure at No-Flow Speed	23-61 Continuous Bin Data
21-30 Ext. 2 Ref./Feedback Unit	21-62 Ext. 3 Integral Time	22-41 Minimum Sleep Time	22-88 Pressure at Rated Speed	23-62 Timed Bin Data
21-31 Ext. 2 Minimum Reference	21-63 Ext. 3 Differentation Time	22-42 Wake-up Speed [RPM]	22-89 Flow at Design Point	23-63 Timed Period Start

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21-32 Ext. 2 Maximum Reference	21-64 Ext. 3 Dif. Gain Limit	22-43 Wake-up Speed [Hz]	22-90 Flow at Rated Speed	23-64 Timed Period Stop
21-33 Ext. 2 Reference Source	**22-** Appl. Functions**	22-44 Wake-up Ref./FB Difference	**23-** Time-based Functions**	23-65 Minimum Bin Value
21-34 Ext. 2 Feedback Source	**22-0* Miscellaneous**	22-45 Setpoint Boost	**23-0* Timed Actions**	23-66 Reset Continuous Bin Data
21-35 Ext. 2 Setpoint	22-00 External Interlock Delay	22-46 Maximum Boost Time	23-00 ON Time	23-67 Reset Timed Bin Data
21-37 Ext. 2 Reference [Unit]	22-01 Power Filter Time	**22-5* End of Curve**	23-01 ON Action	**23-8* Payback Counter**
21-38 Ext. 2 Feedback [Unit]	**22-2* No-Flow Detection**	22-50 End of Curve Function	23-02 OFF Time	23-80 Power Reference Factor
21-39 Ext. 2 Output [%]	22-20 Low Power Auto Set-up	22-51 End of Curve Delay	23-03 OFF Action	23-81 Energy Cost
21-4* Ext. CL 2 PID	22-21 Low Power Detection	**22-6* Broken Belt Detection**	23-04 Occurrence	23-82 Investment
21-40 Ext. 2 Normal/Inverse Control	22-22 Low Speed Detection	22-60 Broken Belt Function	23-08 Timed Actions Mode	23-83 Energy Savings
21-41 Ext. 2 Proportional Gain	22-23 No-Flow Function	22-61 Broken Belt Torque	23-09 Timed Actions Reactivation	23-84 Cost Savings
21-42 Ext. 2 Integral Time	22-24 No-Flow Delay	22-62 Broken Belt Delay	**23-1* Maintenance**	**24-** Appl. Functions 2**
21-43 Ext. 2 Differentation Time	22-26 Dry Pump Function	**22-7* Short Cycle Protection**	23-10 Maintenance Item	**24-0* Fire Mode**
21-44 Ext. 2 Dif. Gain Limit	22-27 Dry Pump Delay	22-75 Short Cycle Protection	23-11 Maintenance Action	24-00 Fire Mode Function
21-5* Ext. CL 3 Ref./Fb.	**22-3* No-Flow Power Tuning**	22-76 Interval between Starts	23-12 Maintenance Time Base	24-01 Fire Mode Configuration
21-50 Ext. 3 Ref./Feedback Unit	22-30 No-Flow Power	22-77 Minimum Run Time	23-13 Maintenance Time Interval	24-02 Fire Mode Unit
21-51 Ext. 3 Minimum Reference	22-31 Power Correction Factor	22-78 Minimum Run Time Override	23-14 Maintenance Date and Time	24-03 Fire Mode Min Reference
21-52 Ext. 3 Maximum Reference	22-32 Low Speed [RPM]	22-79 Minimum Run Time Override Value	23-15 Reset Maintenance Word	24-04 Fire Mode Max Reference
21-53 Ext. 3 Reference Source	22-33 Low Speed [Hz]	**22-8* Flow Compensation**	23-16 Maintenance Text	24-05 Fire Mode Preset Reference
21-54 Ext. 3 Feedback Source	22-34 Low Speed Power [kW]	22-80 Flow Compensation	**23-5* Energy Log**	24-06 Fire Mode Reference Source
21-55 Ext. 3 Setpoint	22-35 Low Speed Power [HP]	22-81 Square-linear Curve Approximation	23-50 Energy Log Resolution	24-07 Fire Mode Feedback Source
21-57 Ext. 3 Reference [Unit]	22-36 High Speed [RPM]	22-82 Work Point Calculation	23-51 Period Start	24-09 Fire Mode Alarm Handling
21-58 Ext. 3 Feedback [Unit]	22-37 High Speed [Hz]	22-83 Speed at No-Flow [RPM]	23-53 Energy Log	**24-1* Drive Bypass**
21-59 Ext. 3 Output [%]	22-38 High Speed Power [kW]	22-84 Speed at No-Flow [Hz]	23-54 Reset Energy Log	24-10 Drive Bypass Function
21-6* Ext. CL 3 PID	22-39 High Speed Power [HP]	22-85 Speed at Design Point [RPM]	**23-6* Trending**	24-11 Drive Bypass Delay Time
24-9* Multi-Motor Funct.	25-25 OBW Time	25-59 Run-on Line Delay	**26-2* Analog Input X42/3**	26-53 Terminal X42/9 Bus Control

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24-90 Missing Motor Function	25-26 Destage At No-Flow	**25-8* Status**	26-20 Terminal X42/3 Low Voltage	26-54 Terminal X42/9 Timeout Preset
24-91 Missing Motor Coeffcient 1	25-27 Stage Function	25-80 Cascade Status	26-21 Terminal X42/3 High Voltage	**26-6* Analog Out X42/11**
24-92 Missing Motor Coeffcient 2	25-28 Stage Function Time	25-81 Pump Status	26-24 Term. X42/3 Low Ref./ Feedb. Value	26-60 Terminal X42/11 Output
24-93 Missing Motor Coeffcient 3	25-29 Destage Function	25-82 Lead Pump	26-25 Term. X42/3 High Ref./ Feedb. Value	26-61 Terminal X42/11 Min. Scale
24-94 Missing Motor Coeffcient 4	25-30 Destage Function Time	25-83 Relay Status	26-26 Term. X42/3 Filter Time Constant	26-62 Terminal X42/11 Max. Scale
24-95 Locked Rotor Function	**25-4* Staging Settings**	25-84 Pump ON Time	26-27 Term. X42/3 Live Zero	26-63 Terminal X42/11 Bus Control
24-96 Locked Rotor Coeffcient 1	25-40 Ramp-down Delay	25-85 Relay ON Time	**26-3* Analog Input X42/5**	26-64 Terminal X42/11 Timeout Preset
24-97 Locked Rotor Coeffcient 2	25-41 Ramp-up Delay	25-86 Reset Relay Counters	26-30 Terminal X42/5 Low Voltage	**31-** Bypass Option**
24-98 Locked Rotor Coeffcient 3	25-42 Staging Threshold	**25-9* Service**	26-31 Terminal X42/5 High Voltage	31-00 Bypass Mode
24-99 Locked Rotor Coeffcient 4	25-43 Destaging Threshold	25-90 Pump Interlock	26-34 Term. X42/5 Low Ref./ Feedb. Value	31-01 Bypass Start Time Delay
25- Cascade Controller**	25-44 Staging Speed [RPM]	25-91 Manual Alternation	26-35 Term. X42/5 High Ref./ Feedb. Value	31-02 Bypass Trip Time Delay
25-0* System Settings	25-45 Staging Speed [Hz]	**26-** Analog I/O Option**	26-36 Term. X42/5 Filter Time Constant	31-03 Test Mode Activation
25-00 Cascade Controller	25-46 De-staging Speed [RPM]	**26-0* Analog I/O Mode**	26-37 Term. X42/5 Live Zero	31-10 Bypass Status Word
25-02 Motor Start	25-47 Destaging Speed [Hz]	26-00 Terminal X42/1 Mode	**24-4* Analog Out X42/7**	31-11 Bypass Running Hours
25-04 Pump Cycling	**25-5* Alternation Settings**	26-01 Terminal X42/3 Mode	26-40 Terminal X42/7 Output	13-19 Remote Bypass Activation
25-05 Fixed Lead Pump	25-50 Lead Pump Alternation	26-02 Terminal X42/5 Mode	26-41 Terminal X42/7 Min. Scale	**35-** Sensor Input Option**
25-06 Number of Pumps	25-51 Alternation Event	**26-1* Analog Input X42/1**	26-42 Terminal X42/7 Max. Scale	**35-0* Temp. Input Mode**
25-2* Bandwidth Settings	25-52 Alternation Time Interval	26-10 Terminal X42/1 Low Voltage	26-43 Terminal X42/7 Bus Control	35-00 Term. X48/4 Temp. Unit
25-20 Staging Bandwidth	25-53 Alternation Timer Value	26-11 Terminal X42/1 High Voltage	26-44 Terminal X42/7 Timeout Preset	35-01 Term. X48/4 Input Type
25-21 Override Bandwidth	25-54 Alternation Prede!ned Time	26-14 Term. X42/1 Low Ref./ Feedb. Value	**26-5* Analog Out X42/9**	35-02 Term. X48/7 Temp. Unit
25-22 Fixed Speed Bandwidth	25-55 Alternate if Load < 50%	26-15 Term. X42/1 High Ref./ Feedb. Value	26-50 Terminal X42/9 Output	35-03 Term. X48/7 Input Type
25-23 SBW Staging Delay	25-56 Staging Mode at Alternation	26-16 Term. X42/1 Filter Time Constant	26-51 Terminal X42/9 Min. Scale	35-04 Term. X48/10 Temp. Unit
25-24 SBW De-staging Delay	25-58 Run Next Pump Delay	26-17 Term. X42/1 Live Zero	26-52 Terminal X42/9 Max. Scale	35-05 Term. X48/10 Input Type

35-06 Temperature Sensor Alarm Function	35-17 Term. X48/4 High Temp. Limit	35-27 Term. X48/7 High Temp. Limit	35-37 Term. X48/10 High Temp. Limit	35-45 Term. X48/2 High Ref./ Feedb. Value
35-1* Temp. Input X48/4	**35-2* Temp. Input X48/7**	**35-3* Temp. Input X48/10**	**35-4* Analog Input X48/2**	35-46 Term. X48/2 Filter Time Constant
35-14 Term. X48/4 Filter Time Constant	35-24 Term. X48/7 Filter Time Constant	35-34 Term. X48/10 Filter Time Constant	35-42 Term. X48/2 Low Current	35-47 Term. X48/2 Live Zero
35-15 Term. X48/4 Temp. Monitor	35-25 Term. X48/7 Temp. Monitor	35-35 Term. X48/10 Temp. Monitor	35-43 Term. X48/2 High Current	
35-16 Term. X48/4 Low Temp. Limit	35-26 Term. X48/7 Low Temp. Limit	35-36 Term. X48/10 Low Temp. Limit	35-44 Term. X48/2 Low Ref./ Feedb. Value	

6 WARNINGS AND ALARMS

6.0.1 System Monitoring

The adjustable frequency drive monitors the condition of its input power, output, and motor factors as well as other system performance indicators. A warning or alarm may not necessarily indicate a problem internal to the adjustable frequency drive itself. In many cases it indicates failure conditions from input voltage, motor load or temperature, external signals, or other areas monitored by the adjustable frequency drive's internal logic. Be sure to investigate those areas exterior to the adjustable frequency drive as indicated in the alarm or warning.

6.0.2 Warning and Alarm Types

Warnings

A warning is issued when an alarm condition is impending or when an abnormal operating condition is present and may result in the adjustable frequency drive issuing an alarm. A warning clears by itself when the abnormal condition is removed.

Alarms

Trip

An alarm is issued when the adjustable frequency drive is tripped, that is, the adjustable frequency drive suspends operation to prevent adjustable frequency drive or system damage. The motor will coast to a stop. The adjustable frequency drive logic will continue to operate and monitor the adjustable frequency drive status. After the fault condition is remedied, the adjustable frequency drive can be reset. It will then be ready to start operation again.

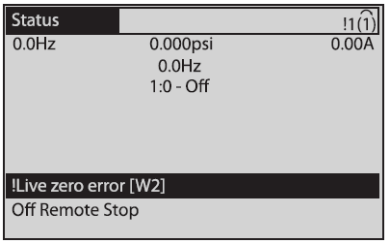
A trip can be reset in any of 4 ways:

- Press [RESET] on the LCP
- Digital reset input command
- Serial communication reset input command
- Auto reset

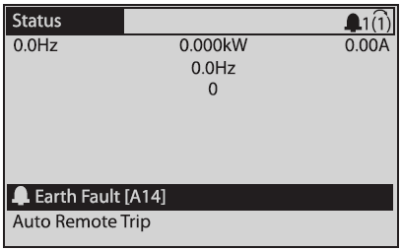
Trip Lock

An alarm that causes the adjustable frequency drive to trip lock requires that input power is cycled. The motor will coast to a stop. The adjustable frequency drive logic will continue to operate and monitor the adjustable frequency drive status. Remove input power to the adjustable frequency drive and correct the cause of the fault, then restore power. This action puts the adjustable fre-quency drive into a trip condition as described above and may be reset in any of those four ways.

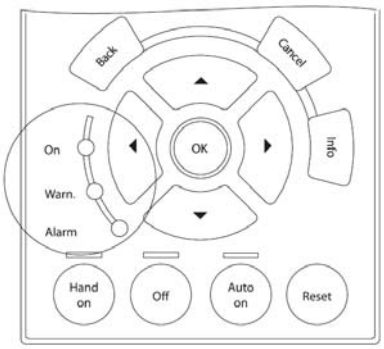
6.0.3 Warning and Alarm Displays



An alarm or trip lock alarm will flash on display along with the alarm number.



In addition to the text and alarm code on the adjustable frequency drive display, the status indicator lights operate.



	Warn. LED	Alarm LED
Warning	ON	OFF
Alarm	OFF	ON (Flashing)
Trip Lock	ON	ON (Flashing)

6.0.4 Warning and Alarm Definitions

The table below defines whether a warning is issued prior to an alarm, and whether the alarm trips the unit or trip locks the unit.

Table 12: Alarm/Warning Code List

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		6-01
4	Mains phase loss	(X)	(X)	(X)	14-12
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC overvoltage	X	X		
8	DC undervoltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR overtemperature	(X)	(X)		1-90
11	Thrmstr overld	(X)	(X)		1-90
12	Torque limit	X	X		
13	Overcurrent	X	X	X	
14	Ground fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word timeout	(X)	(X)		8-04
23	Internal Fan Fault	X			
24	External Fan Fault	X			14-53
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		2-13
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		2-15
29	Drive overtemperature	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	4-58
31	Motor phase V missing	(X)	(X)	(X)	4-58
32	Motor phase W missing	(X)	(X)	(X)	4-58
33	Inrush fault		X	X	
34	Fieldbus communication fault	X	X		
35	Out of frequency range	X	X		
36	Mains failure	X	X		
37	Phase Imbalance	X	X		
38	Internal fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			5-00, 5-01
41	Overload of Digital Output Terminal 29	(X)			5-00, 5-02
42	Overload of Digital Output On X30/6	(X)	5-32		
42	Overload of Digital Output On X30/7	(X)	5-33		
46	Pwr. card supply		X	X	
47	24 V supply low	X	X	X	
48	1.8 V supply low		X	X	
49	Speed limit	X	(X)		1-86
50	AMA calibration failed		X		

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
51	AMA check Unom and Inom		X		
52	AMA low Inom		X		
53	AMA motor too big		X		

No.	Description	Warning Alarm/ Trip	Alarm/Trip Lock	Parameter Reference	
54	AMA motor too small		X		
55	AMA Parameter out of range		X		
56	AMA interrupted by user		X		
57	AMA timeout		X		
58	AMA internal fault	X	X		
59	Current limit	X			
60	External Interlock	X			
62	Output Frequency at Maximum Limit	X			
64	Voltage Limit	X			
65	Control Board Overtemperature	X	X	X	
66	Heatsink Temperature Low	X			
67	Option Configuration has Changed		X		
69	Pwr. Card Temp		X	X	
70	Illegal FC configuration			X	
71	PTC 1 Safe Stop	X	X[1)]		
72	Dangerous Failure			X[1)]	
73	Safe Stop Auto Restart				
76	Power Unit Set-up	X			
79	Illegal PS config		X	X	
80	Drive Initialized to Default Value		X		
91	Analog input 54 wrong settings			X	
92	No-Flow	X	X		22-2*
93	Dry Pump	X	X		22-2*
94	End of Curve	X	X		22-5*
95	Broken Belt	X	X		22-6*
96	Start Delayed	X			22-7*
97	Stop Delayed	X			22-7*
98	Clock Fault	X			0-7*
201	Fire M was Active				
202	Fire M Limits Exceeded				
203	Missing Motor				
204	Locked Rotor				
243	Brake IGBT	X	X		
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr.card supply		X	X	
247	Pwr.card temp		X	X	
248	Illegal PS config		X	X	
250	New spare parts			X	
251	New Type Code		X	X	

(X) Dependent on parameter

[1)] Cannot be Auto reset via 14-20 Reset Mode

6.0.5 Fault Messages

The warning/alarm information below defines the warning/alarm condition, provides the probable cause for the condition, and details a remedy or troubleshooting procedure.

WARNING 1, 10 volts low

The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ohms. This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting

Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error

This warning or alarm will only appear if programmed by the user in 6-01 Live Zero Timeout Function. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or faulty device sending the signal.

Troubleshooting

Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

Check that the adjustable frequency drive programming and switch settings match the analog signal type.

Perform Input Terminal Signal Test.

WARNING/ALARM 4, Mains phase loss

A phase is missing on the supply side, or the line voltage imbalance is too high. This message also appears for a fault in the input rectifier on the adjustable frequency drive. Options are programmed at 14-12 Function at Mains Imbalance.

Troubleshooting

Check the supply voltage and supply currents to the adjustable frequency drive.

WARNING 5, DC link voltage high

The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the adjustable frequency drive voltage rating. The adjustable frequency drive is still active.

WARNING 6, DC link voltage low

The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the adjustable frequency drive voltage rating. The adjustable frequency drive is still active.

WARNING/ALARM 7, DC overvoltage

If the intermediate circuit voltage exceeds the limit, the adjustable frequency drive trips after a time.

Troubleshooting

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate functions in 2-10 Brake Function

Increase 14-26 Trip Delay at Inverter Fault

WARNING/ALARM 8, DC undervoltage

If the intermediate circuit voltage (DC) drops below the undervoltage limit, the adjustable frequency drive checks if a 24 VDC backup supply is connected. If no 24 VDC backup supply is connected, the adjustable frequency drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

Check that the supply voltage matches the

adjustable frequency drive voltage.

Perform Input voltage test

Perform soft charge and rectifier circuit test

WARNING/ALARM 9, Inverter overload

The adjustable frequency drive is about to cut out because of an overload (current too high for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. The adjustable frequency drive cannot be reset until the counter is below 90%.

The fault is that the adjustable frequency drive has been overloaded by more than 100% for too long.

Troubleshooting

Compare the output current shown on the LCP with the adjustable frequency drive rated current.

Compare the output current shown on the LCP with measured motor current.

302-370, Effective: December 21, 2015

Display the Thermal Drive Load on the LCP and monitor the value. When running above the adjustable frequency drive continuous current rating, the counter should increase. When running below the adjustable frequency drive continuous current rating, the counter should decrease.

See the derating section in the *Design Guide* for more details if a high switching frequency is required.

WARNING/ALARM 10, Motor Overload Temperature

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the adjustable frequency drive gives a warning or an alarm when the counter reaches 100% in 1-90 Motor Thermal Protection. The fault occurs when the motor is overloaded by more than 100% for too long.

Troubleshooting

- Check for motor overheating.
- Check if the motor is mechanically overloaded.
- Check that the motor current set in *1-24 Motor Current* is correct.
- Ensure that Motor data in parameters 1-20 through 1-25 are set correctly.
- If an external fan is in use, check in *1-91 Motor External Fan* that it is selected.
- Running AMA in *1-29 Automatic Motor Adaptation (AMA)* may tune the adjustable frequency drive to the motor more accurately and reduce thermal loading.

WARNING/ALARM 11, Thermistor overload

The thermistor might be disconnected. Select whether the adjustable frequency drive gives a warning or an alarm in *1-90 Motor Thermal Protection*.

Troubleshooting

- Check for motor overheating.
- Check if the motor is mechanically overloaded.
- When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply) and that the terminal switch for 53 or 54 is set for voltage. Check *1-93 Thermistor Source* selects terminal 53 or 54.
- When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check *1-93 Thermistor Source* selects terminal 18 or 19.

WARNING/ALARM 12, Torque limit

The torque has exceeded the value in 4-16 Torque Limit Motor Mode or the value in 4-17 Torque Limit Generator Mode. 14-25 Trip Delay at Torque Limit can change this from a warning only condition to a warning followed by an alarm.

Troubleshooting

- If the motor torque limit is exceeded during ramp-up, extend the ramp-up time.
- If the generator torque limit is exceeded during ramp-down, extend the ramp-down time.
- If torque limit occurs while running, possibly increase the torque limit. Be sure the system can operate safely at a higher torque.
- Check the application for excessive current draw on the motor.

WARNING/ALARM 13, Overcurrent

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning lasts about 1.5 sec. Then the adjustable frequency drive trips and issues an alarm. This fault may be caused by shock loading or fast acceleration with high inertia loads. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting

- Remove power and check if the motor shaft can be turned.
- Make sure that the motor size matches the adjustable frequency drive.
- Check parameters 1-20 through 1-25 for correct motor data.

WARNING/ALARM 14, Ground Fault

There is current from the output phases to ground, either in the cable between the adjustable frequency drive and the motor or in the motor itself.

Troubleshooting

- Remove power to the adjustable frequency drive and repair the ground fault.
- Check for ground faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohm meter.

WARNING/ALARM 15, Hardware Mismatch

A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your Danfoss supplier:

15-40 FC Type

15-41 Power Section

15-42 Voltage

15-43 Software Version

15-45 Actual Typecode String

15-49 SW ID Control Card

15-50 SW ID Power Card

15-60 Option Mounted

15-61 Option SW Version

WARNING/ALARM 16, Short Circuit

There is a short circuit in the motor or motor wiring. Remove power to the adjustable frequency drive and repair the short circuit.

WARNING/ALARM 17, Control Word Timeout

There is no communication to the adjustable frequency drive.

The warning will only be active when 8-04 Control Timeout Function is NOT set to [0] OFF.

If 8-04 Control Timeout Function is set to Stop and Trip, a warning appears and the adjustable frequency drive ramps down until it stops then displays an alarm.

Troubleshooting

- Check connections on the serial communication cable.
- Increase *8-03 Control Timeout Time.*
- Check the operation of the communication equipment.
- Verify proper installation based on EMC requirements.

WARNING/ALARM 23, Internal Fan Fault

The fan warning function checks if the fan is running. The fan warning can be disabled in *14-53 Fan Monitor*.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the adjustable frequency drive and check that the fan operates briefly at startup.
- Check the sensors on the heatsink and control card.

WARNING/ALARM 24, External Fan Fault

The fan warning function checks if the fan is running. The fan warning can be disabled in *14-53 Fan Monitor*.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the adjustable frequency drive and check that the fan operates briefly at startup.
- Check the sensors on the heatsink and control card.

WARNING/ALARM 25, Brake Resistor Short Circuit

The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The adjustable frequency drive is still operational but without the brake function. Remove power to the adjustable frequency drive and replace the brake resistor (see *2-15 Brake Check*).

WARNING/ALARM 26, Brake Resistor Power Limit

The power transmitted to the brake resistor is calculated as a mean value over the last 120 seconds of run time. The calculation is based on the intermediate circuit voltage and the brake resistance value set in *2-16 AC Brake Max. Current*. The warning is active when the dissipated braking is higher than 90% of the brake resistance power. If *Trip [2]* is selected in *2-13 Brake Power Monitoring*, the adjustable frequency drive will trip when the dissipated braking energy reaches 100%.

WARNING/ALARM 27, Brake Chopper Fault

The brake transistor is monitored during operation and if a short circuit occurs, the brake function is disabled and a warning is issued. The adjustable frequency drive is still operational but, since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Remove power to the adjustable frequency drive and remove the brake resistor.

WARNING/ALARM 28, Brake Check Failed

The brake resistor is not connected or not working. Check *2-15 Brake Check*.

WARNING/ALARM 29, Heatsink Temp

The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below the reset heatsink temperature. The trip and reset points are based on the adjustable frequency drive power size.

Troubleshooting

Check for the following conditions.

- Ambient temperature too high.
- Motor cable too long.
- Incorrect airflow clearance above and below the adjustable frequency drive.
- Blocked airflow around the adjustable frequency drive.
- Damaged heatsink fan.
- Dirty heatsink.

WARNING/ALARM 30, Motor phase U missing

Motor phase U between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase U.

WARNING/ALARM 31, Motor phase V missing

Motor phase V between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase V.

WARNING/ALARM 30, Motor phase W missing

Motor phase W between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase W.

WARNING/ALARM 33, Inrush Fault

Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, Fieldbus Communication Fault

Communication between the serial communication bus and the communication option card is not operating.

WARNING/ALARM 36, Mains Failure

This warning/alarm is only active if the supply voltage to the adjustable frequency drive is lost and *14-10 Mains Failure* is NOT set to *[0] No Function*. Check the fuses to the adjustable frequency drive and line power supply to the unit.

WARNING/ALARM 36, Internal Fault

When an internal fault occurs, a code number defined in the table below is displayed.

Troubleshooting

- Cycle power to the adjustable frequency drive.
- Check that the option is properly installed.
- Check for loose or missing wiring.

It may be necessary to contact your Danfoss supplier or service department. Note the code number for further troubleshooting directions.

No.	Text
0	Serial port cannot be initialized. Contact your Danfoss supplier or Danfoss Service Department.
256-258	Power EEPROM data is defect or too old.
512-519	Internal fault. Contact your Danfoss supplier or Danfoss Service Department.
783	Parameter value outside of min/max limits
1024-1284	Internal fault. Contact your Danfoss supplier or the Danfoss Service Department.
1299	Option SW in slot A is too old.
1300	Option SW in slot B is too old.
1302	Option SW in slot C1 is too old.
1315	Option SW in slot A is not supported (not allowed).
1316	Option SW in slot B is not supported (not allowed).
1318	Option SW in slot C1 is not supported (not allowed).
1379-2819	Internal fault. Contact your Danfoss supplier or Danfoss Service Department.
2820	LCP stack overflow.
2821	Serial port overflow.
2822	USB port overflow.
3072-5122	Parameter value is outside its limit.
5123	Option in slot A: Hardware incompatible with control board hardware.
5124	Option in slot B: Hardware incompatible with control board hardware.
5125	Option in slot C0: Hardware incompatible with control board hardware.
5126	Option in slot C1: Hardware incompatible with control board hardware.
5376-6231	Internal fault. Contact your Danfoss supplier or Danfoss Service Department.

WARNING/ALARM 39, Heatsink Sensor

No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING/ALARM 40, Overload of digital output terminal 27

Check the load connected to terminal 27 or remove short-circuited connection. Check *5-00 Digital I/O Mode* and *5-01 Terminal 27 Mode*.

WARNING/ALARM 40, Overload of digital output terminal 29

Check the load connected to terminal 27 or remove short-circuited connection. Check *5-00 Digital I/O Mode* and *5-01 Terminal 29 Mode*.

WARNING/ALARM 40, Overload of digital output on X30/6 or overload of digital output on x30/7

For X30/6, check the load connected to X30/6 or remove short-circuit connection. Check *5-32 Term X30/6 Digi Out (MCB 101)*.

For X30/7, check the load connected to X30/7 or remove short-circuit connection. Check *5-33 Term X30/7 Digi Out (MCB 101)*.

WARNING/ALARM 45, Ground Fault 2

Ground fault on start-up.

Troubleshooting

- Check for proper grounding and loose connections.
- Check for proper wire size.
- Check motor cables for short-circuits or leakage currents.

WARNING/ALARM 46, Power Card Supply

The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, +/- 18 V. When powered with 24 VDC with the MCB 107 option, only the 24 V and 5 V supplies are monitored. When powered with three phase AC line voltage, all three supplied are monitored.

Troubleshooting

- Check for a defective power card.
- Check for a defective control card.
- Check for a defective option card.
- If a 24 VDC power supply is used, verify proper supply power.

WARNING/ALARM 47, 24 V Supply Low

The 24 V DC is measured on the control card. The external 24 VDC backup power supply may be overloaded; otherwise, contact your Danfoss supplier.

WARNING/ALARM 48, 1.8 Supply Low

The 1.8V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an option card is present, check for an overvoltage condition.

WARNING/ALARM 49, Speed Limit

When the speed is not within the specified range in *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]*, the adjustable frequency drive will show a warning. When the speed is below the specified limit in *1-86 Trip Speed Low [RPM]* (except when starting or stopping), the adjustable frequency drive will trip.

ALARM 50, AMA calibration failed

Contact your Danfoss supplier or Danfoss Service Department.

ALARM 51, AMA check U_{nom} and I_{nom}

The settings for motor voltage, motor current, and motor power are wrong. Check the settings in parameters 1-20 to 1-25.

ALARM 52, AMA low I_{nom}

The motor current is too low. Check the setting in *4-18 Current Limit*.

ALARM 53, AMA motor too big

The motor is too big for the AMA to operate.

ALARM 54, AMA motor too small

The motor is too small for the AMA to operate.

ALARM 55, AMA parameter out of range

The parameter values of the motor are outside of the acceptable range. AMA will not run.

ALARM 56, AMA interrupted by user

The AMA has been interrupted by the user.

ALARM 57, AMA timeout

Try to restart AMA again. Repeated restarts may overheat the motor.

ALARM 58, AMA internal fault

Contact your Danfoss supplier.

WARNING 59, Current limit

The current is higher than the value in *4-18 Current Limit*. Ensure that Motor data in parameters 1-20 through 1-25 are set correctly. Possibly increase the current limit. Be sure the system can operate safely at a higher limit.

ALARM 60, External interlock

A digital input signal is indicating a fault condition external to the adjustable frequency drive. An external interlock has commanded the adjustable frequency drive to trip. Clear the external fault condition. To resume normal operation, apply 24 VDC to the terminal programmed for external interlock. Reset the adjustable frequency drive.

WARNING 62, Output frequency at maximum limit

The output frequency has reached the value set in *4-19 Max Output Frequency*. Check the application to determine the cause. Possibly increase the output frequency limit. Be sure the system can operate safely at a higher output frequency. The warning will clear when the output drops below the maximum limit.

WARNING/ALARM 65, Control card over temperature

The cutout temperature of the control card is 176°F [80 °C].

Troubleshooting

- Check that the ambient operating temperature is within limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

WARNING 66, Heatsink temperature low

The adjustable frequency drive is too cold to operate. This warning is based on the temperature sensor in the IGBT module. Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the adjustable frequency drive whenever the motor is stopped by setting *2-00 DC Hold/Preheat Current* at 5% and *1-80 Function* at Stop.

ALARM 67, Option module configuration has changed

One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the adjustable frequency drive.

ALARM 68, Safe stop activated

Loss of the 24 VDC signal on terminal 37 has caused the adjustable frequency drive to trip. To resume normal operation, apply 24 VDC to terminal 37 and reset the adjustable frequency drive.

ALARM 69, Power card temperature

The temperature sensor on the power card is either too hot or too cold.

ALARM 70, Illegal FC configuration

The control card and power card are incompatible. Contact your supplier with the typecode of the unit from the nameplate and the part numbers of the cards to check compatibility.

ALARM 80, Drive initialized to default value

Parameter settings are initialized to default settings after a manual reset. Reset the unit to clear the alarm.

ALARM 92, No-flow

A no-flow condition has been detected in the system. *22-23 No-Flow Function* is set for alarm. Troubleshoot the system and reset the adjustable frequency drive after the fault has been cleared.

ALARM 93, Dry pump

A no-flow condition in the system with the frequency converter operating at high speed may indicate a dry pump. *22-26 Dry Pump Function* is set for alarm. Troubleshoot the system and reset the frequency converter after the fault has been cleared.

ALARM 94, End of curve

Feedback is lower than the setpoint. This may indicate leakage in the system. *22-50 End of Curve Function* is set for alarm. Troubleshoot the system and reset the adjustable frequency drive after the fault has been cleared.

ALARM 95, Broken belt

Torque is below the torque level set for no load, indicating a broken belt. *22-60 Broken Belt Function* is set for alarm. Troubleshoot the system and reset the adjustable frequency drive after the fault has been cleared.

ALARM 96, Start delayed

Motor start has been delayed due to short-cycle protection. *22-76 Interval between Starts* is enabled. Troubleshoot the system and reset the adjustable frequency drive after the fault has been cleared.

WARNING 97, Stop delayed

Stopping the motor has been delayed due to short cycle protection. *22-76 Interval between Starts* is enabled. Troubleshoot the system and reset the adjustable frequency drive after the fault has been cleared.

WARNING 98, Clock fault

Time is not set or the RTC clock has failed. Reset the clock in *0-70 Date and Time*.

WARNING 200, Fire mode

This indicates the adjustable frequency drive is operating in fire mode. The warning clears when fire mode is removed. See the fire mode data in the alarm log.

WARNING 201, Fire mode was active

This indicates the adjustable frequency drive had entered fire mode. Cycle power to the unit to remove the warning. See the fire mode data in the alarm log.

WARNING 202, Fire mode limits exceeded

While operating in fire mode one or more alarm conditions has been ignored which would normally trip the unit. Operating in this condition voids unit warranty. Cycle power to the unit to remove the warning. See the fire mode data in the alarm log.

WARNING 203, Missing motor

With an adjustable frequency drive operating multi-motors, an underload condition was detected. This could indicate a missing motor. Inspect the system for proper operation.

WARNING 204, Locked rotor

With an adjustable frequency drive operating multi-motors, an overload condition was detected. This could indicate a locked rotor. Inspect the motor for proper operation.

WARNING 250, New spare part

A component in the adjustable frequency drive has been replaced. Reset the adjustable frequency drive for normal operation.

WARNING 251, New type code

A component in the adjustable frequency drive has been replaced and the type code changed. Reset the adjustable frequency drive for normal operation.

6.1 Supplemental Warning and Alarm Settings

6.1.1 End-Of-Curve

Definition: End-of-curve = pump yielding too large a volume to ensure the set pressure @ 60Hz max speed condition).

Pump response options:

- off [0],
- warning + run [1] (Factory default mode for SelfSensing pump)
- alarm + trip [2]
- manual reset alarm [3]

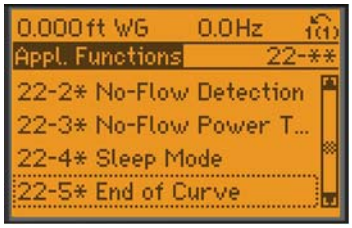
End-Of-Curve Settings

1. Press [Main Menu].

2. Scroll down to parameter *22-** Appl. Functions*.

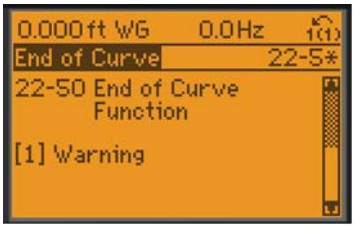
3. Press [OK].

4. Scroll Down to parameter *22-5* End of Curve*.



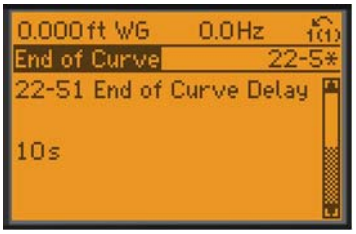
5. Press [OK].

6. Press [OK] to change parameter ***25-50 End of Curve Function.***



7. Change parameter *22-50* to desired feature.
8. Press [Back].

9. Scroll down to parameter *25-51 End of Curve Delay*.



10. Select the amount of time the pump will run after end-of-curve is detected, before going into the mode selected in Parameter **25-50**.

6.1.2 Function at Inverter Overload

Definition: Function at Inverter overload = running along HP limit curve.

Pump response options:

- default VFD trips at 110% rated current [0];

- de-rate VFD when load exceeds rating via speed reduction [1]. (Factory default mode for SelfSensing pump)

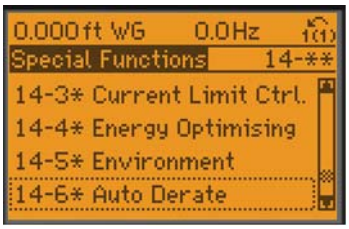
Function at Inverter Overload Settings

1. Press [Main Menu].

2. Scroll Down to parameter *14-** Special Functions*.

3. Press [OK].

4. Scroll Down to parameter *14-6* Auto Derate*.



5. Scroll down to parameter *14-61 Function at Inverter Overload*.

6. Press [OK].

7. Change parameter *14-61* to desired feature.

7 SPECIFICATIONS

7.1 Power-dependent Specifications

Table 13: Line Power Supply 200-240 V AC

Line Power Supply 200-240 V AC - Normal overload 110% for 1 minute					
Adjustable frequency drive Typical Shaft Output [kW]	**P1K1** **1.1**	**P1K5** **1.5**	**P2K2** **2.2**	**P3K0** **3**	**P3K7** **3.7**
IP20, IP21 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)]	4, 4, 4 (12, 12, 12) (min. 0.2 (24))				
IP55, IP66 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)]	4, 4, 4 (12, 12, 12)				
Max. cable cross-section with disconnect	6, 4, 4, (10, 12, 12)				

Table 14: Line Power Supply 3 x 200-240 V AC

Line Power Supply 3 x 200-240 V AC - Normal overload 110% for 1 minute					
Adjustable frequency drive Typical Shaft Output [kW]	**P5K5** **5.5**	**P7K5** **7.5**	**P11K** **11**	**P15K** **15**	**P18K** **18.5**
IP20, IP21 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)]	10, 10 (8,8-)		35,-,- (2,-,-)	35 (2)	50 (1)
IP21, IP55, IP66 max. cable cross-section (line power, motor) [mm^2 (AWG)]	10, 10 (8,8-)		35, 25, 25 (2, 4, 4)	50 (1)	
IP21, IP55, IP66 max. cable cross-section (brake, load sharing) [mm^2 (AWG)]	16, 10, 16 (6, 8,6)		35,-,- (2,-,-)	50 (1)	

Table 15: Line Power Supply 3 x 200-240 V AC

Line Power Supply 3 x 200-240 V AC - Normal overload 110% for 1 minute				
Adjustable frequency drive Typical Shaft Output [kW]	**P22K** **22**	**P30K** **30**	**P37K** **37**	**P45K** **45**
IP20, IP21 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)]		150 (300 MCM)		
IP21, IP55, IP66 max. cable cross-section (line power, motor) [mm^2 (AWG)]		150 (300 MCM)		
IP21, IP55, IP66 max. cable cross-section (brake, load sharing) [mm^2 (AWG)]		95 (3/0)		

Table 16: Line Power Supply 3 x 380-480 V AC

Line Power Supply 3 x 380-480 V AC - Normal overload 110% for 1 minute							
Adjustable frequency drive Typical Shaft Output [kW]	**P1K1** **1.1**	**P1K5** **1.5**	**P2K2** **2.2**	**P3K0** **3**	**P4K0** **4**	**P5K5** **5.5**	**P7K5** **7.5**
Typical Shaft Output [HP] at 460 V	1.5	2.0	2.9	4.0	5.0	7.5	10
IP20, IP21 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)] [1)]	4, 4, 4 (12, 12, 12) (min. 0.2 (24))						
IP55, IP66 max. cable cross-section (line power, motor, brake and load sharing) [mm^2 (AWG)] [1)]	4, 4, 4 (12, 12, 12)						
Max. cable cross-section with disconnect	6, 4, 4 (10, 12, 12)						

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Table 17: Line Power Supply 3 x 380-480 V AC

Line Power Supply 3 x 380-480 V AC - Normal overload 110% for 1 minute					
Adjustable frequency drive Typical Shaft Output [kW]	**P11K 11**	**P15K 15**	**P18K 18.5**	**P22K 22**	**P30K 30**
Typical Shaft Output [HP] at 460 V 15 20 25 30 40	15	20	25	30	40
IP20 max. cable cross-section (line power, brake, motor and load sharing)	16, 10, - (8, 8, -)		35,-,- (2,-,-)		35 (2)
IP21, IP55, IP66 max. cable cross-section (line power, motor) [mm^2 (AWG)]	10, 10, 16 (6, 8, 6)		35, 25, 25 (2, 4, 4)		50 (1)
IP21, IP55, IP66 max. cable cross-section (brake, load sharing) [mm^2 (AWG)]	10, 10, - (8, 8, -)		35, -, - (2, -, -)		50 (1)

Table 18: Line Power Supply 3 x 380-480 V AC

Line Power Supply 3 x 380-480 V AC - Normal overload 110% for 1 minute					
Adjustable frequency drive Typical Shaft Output [kW]	**P37K 37**	**P45K 45**	**P55K 55**	**P75K 75**	**P90K 90**
Typical Shaft Output [HP] at 460 V 15 20 25 30 40	50	60	75	100	125
IP20 max. cable cross-section (line power, brake, motor and load sharing)	50 (1)		150 (300 MCM)		
IP21, IP55, IP66 max. cable cross-section (line power, motor) [mm2 (AWG)]			150 (300 MCM)		
IP21, IP55, IP66 max. cable cross-section (brake, load sharing) [mm2 (AWG)]			95 (3/0)		

Table 19: With brake and load sharing 95 / 4/0

Line Power Supply 3 x 525-600 V AC - Normal overload 110% for 1 minute									
Size:	**P1K1**	**P1K5**	**P2K2**	**P3K0**	**P3K7**	**PK40**	**P5K5**	**P7K5**	**P11K**
Typical Shaft Output [kW]	1.1	1.5	2.2	3	3.7	4	5.5	7.5	11
IP20 max. cable cross-section (line power, motor, brake and load sharing) [mm^2]/[AWG]	4, 4, 4 (12, 12, 12) (min. 0.2 (24))								
IP55, IP66 max. cable cross-section (line power, motor, brake and load sharing) [mm2]/[AWG]	4, 4, 4 (12, 12, 12) (min. 0.2 (24))								
Max. cable cross-section with disconnect	6, 4, 4 (12, 12, 12)								

Table 20: With brake and load sharing 95 / 4/0

Line Power Supply 3 x 525-600 V AC - Normal overload 110% for 1 minute									
Size:	**P15K**	**P18K**	**P22K**	**P30K**	**P37K**	**P45K**	**P55K**	**P75K**	**P90K**
Typical Shaft Output [kW]	15	18.5	22	30	37	45	55	75	90
IP20 max. cable cross-section (line power, motor, brake and load sharing) [mm^2]/[AWG]									
IP55, IP66 max. cable cross-section (line power, motor, brake and load sharing) [mm2]/[AWG]									
Max. cable cross-section with disconnect									

7.1.1 Line Power Supply 3 x 525-690 V AC

Table 21: Line Power Supply 3 x 525-690 V AC

Normal overload 110% for 1 minute							
Adjustable frequency drive Typical Shaft Output [kW]	**P1K1 1.1**	**P1K5 1.5**	**P2K2 2.2**	**P3K0 3**	**P4K0 4**	**P5K5 5.5**	**P7K5 7.5**
IP20 max. cable cross-section (line power, motor, brake and load sharing) [mm^2]/(AWG)	[0.2-4]/(24-10)						

Table 22: Line Power Supply 3 x 525-690 V AC IP20-Chassis/IP21-IP55/NEMA 1-NEMA12

Normal overload 110% for 1 minute						
Adjustable frequency drive Typical Shaft Output [kW]	**P11K 11**	**P15K 15**	**P18K 18**	**P22K 22**	**P45K 45**	**P55K 55**
Typical Shaft Output [HP] at 575V	16.4	20.1	24	33	60	75
Max. cable size (line power, motor, brake) [mm2]/(AWG) [1)]	[35]/(1/0)				[50]/(1)	

Table 23: Line Power Supply 3 x 525-690 V AC IP21-IP55/NEMA 1-NEMA 12

Normal overload 110% for 1 minute					
Adjustable frequency drive Typical Shaft Output [kW]	**P30K 30**	**P37K 37**	**P45K 45**	**P55K 55**	**P75K 75**
Typical Shaft Output [HP] at 575V	40	60	60	75	100
Max. cable size (line power, motor, brake) [mm2]/(AWG) [1)]	[95]/(4/0)				

[1)] American Wire Gauge

7.2 Connection Tightening Torques

Table 24: Tightening of Terminals

	Power (kW)			Torque (Nm)						
Enclosure	**200-240 V**	**380-480/ 500 V**	**525-600 V**	**525-690 V**	**Line Power**	**Motor**	**DC Connection**	**Brake**	**Ground**	**Relay**
A2	1.1-2.2	1.1-4.0			0.6	0.6	0.6	1.8	3	0.6
A3	3.0-3.7	5.5-7.5	1.1-7.5	1.1-7.5	0.6	0.6	0.6	1.8	3	0.6
A4	1.1-2.2	1.1-4.0			0.6	0.6	0.6	1.8	3	0.6
A5	1.1-3.7	1.1-7.5	1.1-7.5		0.6	0.6	0.6	1.8	3	0.6
B1	5.5-11	11-18	11-18		1.8	1.8	1.5	1.5	3	0.6
B2	15	22-30	22-30	11-30	4.5	4.5	3.7	3.7	3	0.6
B3	5.5-11	11-18	11-18		1.8	1.8	1.8	1.8	3	0.6
B4	15-18	22-37	22-37	11-37	4.5	4.5	4.5	4.5	3	0.6
C1	18-30	37-55	37-55		10	10	10	10	3	0.6
C2	37-45	75-90	75-90	37-90	14/24 [1)]	14/24 [1)]	14	14	3	0.6
C3	22-30	45-55	45-55	45-55	10	10	10	10	3	0.6
C4	37-45	75-90	75-90		14/24 [1)]	14/24 [1)]	14	14	3	0.6

[1)] For different cable dimensions x/y, where x <= 0.147 in^2 [95 mm^2] and y >= 0.147 in^2 [95 mm^2].

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LIMITED WARRANTY STATEMENT

Taco, Inc. (Taco) will repair or replace without charge (at the company's option) any product or part which is proven defective under normal use within one (1) year from the date of start-up or one (1) year and six (6) months from date of shipment (whichever occurs first).

In order to obtain service under this warranty, it is the responsibility of the purchaser to promptly notify the local Taco stocking distributor or Taco in writing and promptly deliver the subject product or part, delivery prepaid, to the stocking distributor. For assistance on warranty returns, the purchaser may either contact the local Taco stocking distributor or Taco. If the subject product or part contains no defect as covered in this warranty, the purchaser will be billed for parts and labor charges in effect at time of factory examination and repair.

Any Taco product or part not installed or operated in conformity with Taco instructions or which has been subject to accident, disaster, neglect, misuse, misapplication, inadequate operating environment, repair, attempted repair, modification or alteration, or other abuse, will not be covered by this warranty.

Taco products are not intended for use to support fire suppression systems, life support systems, critical care applications, commercial aviation, nuclear facilities or any other applications where product failure could lead to injury to person, loss of life, or catastrophic property damage and should not be sold for such purposes.

If in doubt as to whether a particular product is suitable for use with a Taco product or part, or for any application restrictions, consult the applicable Taco instruction sheets or in the U.S. contact Taco at 401-942-8000 and in Canada contact Taco (Canada) Limited at 905-564-9422.

Taco reserves the right to provide replacement products and parts which are substantially similar in design and functionally equivalent to the defective product or part. Taco reserves the right to make changes in details of design, construction, or arrangement of materials of its products without notification.

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TACO WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS OR ANY INCIDENTAL COSTS OF REMOVING OR REPLACING DEFECTIVE PRODUCTS.

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